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FERTILITY OF BULLS, AND ARTIFICIAL INSEMINATION *

PART I: BY G. N. GOULD, M.R.C.V.S., SOUTHAMPTON

PART II (Report on Work at the Hampshire Cattle Breeding Centre): BY G. H. BENNETT, M.R.C.V.S.

PART I

The maintenance of a high fertility rate is essential to the economic working of a centre and is a centre's major responsibility to the farmers using the service.

This paper is a preliminary report covering results achieved at the Lyndhurst centre since its inception and including a period of prolonged, and for a long period, apparently inexplicable low fertility and recovery therefrom. It is realised that a longer testing period would have been desirable, but the improved fertility rate achieved so promptly, and constantly maintained following the laying down of definite changes in technical and management policy, leads me to believe that the measures taken are of sufficient moment to warrant publication.

During the period of low fertility which continued almost unchanged from March, 1948, to July, 1949, many authorities were consulted and the literature explored. In an attempt to improve fertility, on that advice a number of measures were taken most of which are recorded in the report by G. H. Bennett which follows, and none of which brought about improvement.

It was known that low conception rates had occurred and were occurring both in centres in this country and abroad, and that recovery had ensued in some cases; but no accurate information was available as to the cause or, more important, the reasons for recovery. From the limited information available recovery appeared in the known cases to have been quite fortuitous but there was some indication that replacement of bulls was a likely factor, together with rest from service of bulls showing low fertility.

In discussions which took place during this period with individuals responsible for the running and control of A.I. centres there was unanimity on all matters appertaining to most technical procedures, with some difference in opinion regarding the intervals between collections. It was agreed that a collection at intervals of three, five or seven days with variations for individual bulls was normal practice. The definition of a collection, however, varied considerably, some taking two, three or four ejaculates, depending on the amount of bulk semen required.

Discarded ejaculates were mentioned, in discussion, but appeared not to be included in the majority of the records maintained. It is worth mentioning that an average of two ejaculates every five days means 146 ejaculates in 12 months.

As a result of these deliberations, I recommended immediate changes in management policy leading to a marked reduction in the number of ejaculates collected. In order to effect this policy, it was necessary to provide temporary alternative sources of semen where possible and in consequence a considerable sum of money had to be allocated by the management committee of the centre for the purchase of semen.

A policy of rest for one month of all bulls in the centre was decided upon. Plans were made to increase the stud of bulls in order to permit one month's rest period in four as a regular routine for the future. (This has only just been achieved.)

As a feature of future management during the nine months' working period, "collections" were not on any account to exceed an average of 1.5 ejaculates per collection every five days, including all discards, and were to be kept as near as possible to one ejaculate per collection. Increased dilution rates up to 1 : 50, or even higher, were permissible, if such were necessary, to maintain the bulk of semen required for the work of the centre.

Only a small proportion of bulls could be rested immediately since alternative supplies of semen of the breeds concerned were not available in adequate amount.

"Stimulation" and "frustration" methods of collection, which appear to be in common use in A.I. centres, had been introduced and had grown up with the lowered fertility rate. These practices were stopped immediately where the bulls would serve without them and definitely on the return of bulls from the rest period.

Arrangements were made for a resting station for the bulls away from the excitement of the centre, and for the stud of bulls, mainly old bulls, to be increased to permit the programme to be followed for the semen requirements of the centre.

The financial outlay was considerable, but the previous history of the Lyndhurst centre over a long period of high fertility during which ejaculates had been restricted, and the complete failure of any other recommendations to bring about improvement, gave the management committee sufficient confidence to follow the advice offered, following consultations with Professors Dalling and Miller.

The significance of the rest period as compared with the effect of reduced ejaculates is impossible to assess at the present time and is the subject of future enquiry. If, in fact, rest periods are of value in the maintenance of high fertility, enquiry must follow into the optimum period and the spacing. Under conditions of natural service the value of a rest period, together with restricted use, is already accepted.

Its introduction was based on two factors, the first—the need for rest of the over-ejaculated bulls in use, and the second—the provision of a simple means of reducing the number of ejaculates taken during a year without undue disturbance of the organisation of the centre. It is possible, and in my view probable, that a longer interval than five days between collections is desirable for yet higher fertility and the scope of investigation is being widened with this thought in mind. If semen can be produced which will lend itself to yet higher dilution with the maintenance of

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high fertility in the field, and second- and third-, and even fourth-day semen can be used, as was in fact successfully done at Lyndhurst in the first two years of operations, it will make possible even longer periods between collections, (if such proves desirable) without the maintenance of an unduly large stud of bulls. The problem of service from nominated bulls will be solved if and when development in storage technique permits the use of seven-day-old semen.

The scheme commenced at the beginning of July, 1949. In that month a conception rate of 49.1 was recorded from semen of the low fertility bulls used at higher dilutions than in the previous months. The first of the rested bulls came back into service late in August. The conception rate in that month was 52.6 per cent. For September, when further rested bulls came back and the period of reduced numbers of ejaculates had extended over two months, the conception rate was 57.7 per cent. and in October, when the resting programme was practically completed and the programme of reduced ejaculates had been further extended, the conception rate was 69 per cent. and this rate has been maintained.

The following figures taken from a recent report to the management committee of the Hampshire Cattle Breeders' Society giving comparable figures for the same months in 1948, 1949 and 1950, illustrate vividly the significance of conception rate.

1948	*Conception Rate*	*First Inseminations*	*Repeats*
January	66.6 per cent.	March, 1948	March, 1948
February	67.7 per cent.	1,569	1,475
March	52.9 per cent.		
1949			
January	65.9 per cent.	March, 1949	March, 1949
February	49.3 per cent.	1,571	1,906
March	54.0 per cent.		
1950			
January	69.4 per cent.	March, 1950	March, 1950
February	69.0 per cent.	1,525	1,005
March	69.0 per cent.		

As will be seen from these figures, the high fertility rate achieved in the months prior to March, 1950, reduced the number of repeats by 900 compared with March, 1949, and by 470 compared with March, 1948. The financial loss and the wastage of semen which must ensue when fertility is low is of great importance to the economic running of a centre.

Records indicate that throughout the period of low fertility of the bulls in use certain herds maintained a high conception rate, indicating the relative influence of the degree of fertility of the female in the overall picture of conception rate and the need for A.I. centres to aim for highly fertile semen if optimum results are to be obtained in herds as a whole. It would seem that highly fertile females will conceive readily to high, average, or low fertility semen, but that average or low fertility females will show a progressively lowering conception rate to less fertile semen.

Management of Bulls

My experience of bulls both for use by natural service and for artificial insemination has given me definite opinions on management factors likely to affect fertility. I have been reminded that in natural service a bull could ejaculate many more times than are now recommended under the system of management introduced at the Lyndhurst centre, and that one must not overlook the tendency for bulls to masturbate.

It is my belief that if we are to provide bulls of high fertility for artificial insemination centres the management of these bulls could well begin at the commencement of service life ; in any case it should be strictly regulated when they enter a centre.

The average young bull *under good management* turned out with heifers, has, in fact, a very restricted service life—subject to the fertility of the heifers being of a reasonable average. Where the fertility of the heifers is low, the fertility of the young bull tends to depreciate rapidly from overwork.

How often one finds the fertility of a young bull running with heifers ruined by such a train of circumstances. The restricted use following the initial active period and the rest usual under ordinary farm conditions at the end of the service season are of undoubted importance. Whether or not each individual heifer is served many times during the bulling period, as is often claimed, I cannot say with certainty—but two factors are involved: the desire of the bull and the decision of the heifer to stand or move on. My limited observations do not support the many services statement. Detailed recorded observations over a wide field would be valuable.

Masturbation varies in degree in bulls and even in the same bull. In the majority it simply consists of engorgement within the prepuce and the dribbling of accessory fluids with perhaps some slight admixture of semen. The bull in natural service which masturbates regularly with partial thrust is one which, in my experience, tends to lose fertility early in service life. A bull with this vice is undesirable for artificial insemination work.

It is necessary to draw a distinction between ability and desire to serve, and fertility. The naturally slow server is an undesirable animal for artificial insemination purposes because of the time factor. On the other hand, rapidity or violence of service is no indication of degree of fertility.

The desirable bull for artificial insemination purposes is the one which will come out, approach the teaser and with little or no ado proceed to mount and serve. It is my belief that intelligent management aimed at a reasonable number of ejaculates will maintain the bull with a high degree of fertility and with that characteristic service behaviour *if he possesses it naturally ;* whereas the taking of too many ejaculates will lead to reduced fertility accompanied by a lessened desire to serve, and the need for stimulation and frustration methods of collection. The bull which under good management requires stimulation and frustration to make him serve is undesirable for artificial insemination since he is unreliable. The need for such methods of collection is, in my view, a reflection on management and must be productive of inhibitions: in bulls capable of normal service behaviour, it is to be deprecated.

The rhythm of the act of service should not be interrupted. The stimulus of the walk out and the view of the standing teaser, with rapid response by the mounting and approach, the bull standing on its back legs and taking one or more steps forward followed by the characteristic thrust in which he leaves the ground, is dependent on a neuromuscular mechanism, which, in my opinion, should never be interrupted deliberately, in an attempt to provide excitement or stimulus and possible added violence of thrust. There may be variations in behaviour of the same bull, but if they occur they should be voluntary on the part of the bull—not induced by methods of handling.

Discussion

If there was any concrete evidence that " stimulation " of bulls one by the other, or permitting them to watch other bulls at service, etc., had any beneficial effect on service behaviour or fertility, or that " frustration " such as that induced by deflection of the penis, gripping it tightly when the bull mounts, or by pulling the bull off the teaser once it is mounted, were beneficial from the point of view of fertility or future behaviour of the bull then there would be some justification for these practices. Is the dribbling of accessory fluid and the more vigorous thrust which it is claimed is induced, productive of semen of higher fertility? This I do not accept.

Bulls vary in their service behaviour and fertility, but I believe that management is the important factor in the maintenance of a high standard. While semen of too frequently ejaculated bulls will fertilise, the overall picture of conception rates shows a heavy percentage reduction—particularly in herds of cows and heifers of low or average fertility as compared to herds of high fertility.

Where a bull comes into a centre with a history of high fertility in natural service, that high fertility—I emphasise high fertility—will be maintained only if management is designed to limit ejaculates to a reasonably average number over the course of a year and in the light of present experience I believe it should not exceed 50 per annum.

I appreciate the argument that bulls vary considerably in their capacity to produce semen of high fertilising value and that individual bulls could perhaps be ejaculated more frequently than is recommended and still maintain high fertility. This, in my view, must be related to the period over which the increased number of ejaculates is collected and the spacing between the collections. It is my opinion, however, that management must concern itself with the average bull—not the exceptional bull, in view of the large number required for artificial insemination throughout the country and the admitted difficulty at the present time of assessing fertilising capacity and maintenance of fertilising capacity, other than in those cases in which gross departures are present in motility, morphology, or viability, by any method except direct use of semen in the field.

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PART II

Report on Work at the Hampshire Cattle Breeding Centre

The Hampshire Cattle Breeders' Society commenced operations in February, 1945, at the Lyndhurst centre. Three sub-centres were opened at Andover, Petersfield and the Isle of Wight in 1945, 1946 and 1947. The results obtained at the Lyndhurst Centre only are considered in this paper to permit a full comparison of methods and conception rates over the whole period of operations.

The conception rates obtained by the Lyndhurst centre are shown in the graph and up to the end of August, 1949, can be divided into five main periods.

Table I

Period	Average conception rate Per cent.	Lowest Per cent.	Highest Per cent.
1. Feb. 1945 to Nov. 1946 (22 months)	72·0	68·5	75·8
2. Dec. 1946 to Feb. 1948 (15 ,,)	68	64·5	70·6
3. Mar. 1948 to Oct. 1948 (8 ,,)	49·8	41·3	54·4
4. Nov. 1948 to Jan. 1949 (3 ,,)	64·1	62·3	65·9
5. Feb. 1949 to Aug. 1949 (7 ,,)	52·2	49·1	54·8

In September, 1949, the conception rate rose to 57·7 per cent. and attained 69 per cent. in October. It has remained at about this level throughout from October, 1949, to March, 1950.

Table II

Conception Rates

	Per cent.		Per cent.
March, 1949 ...	54·0	October, 1949...	69·0
April, 1949 ...	54·0	November, 1949	70·7
May, 1949 ...	51·3	December, 1949	70·8
June, 1949 ...	54·8	January, 1950...	69·0 (predicted)
July, 1949 ...	49·1	February, 1950	69·0 (,,)
August, 1949 ...	52·6	March, 1950 ...	70·0 (,,)
September, 1949	57·7		

The writer was not appointed to the Lyndhurst centre until May, 1948, and, consequently, has no knowledge of the character of the semen prior to that date. (Between 1945 and 1948 there were two changes in C.V.O.) From that time until August, 1949, however, it was noted that, although an ejaculate of semen was of good density and motility, after dilution and storage for 24 hours, motility had become greatly reduced and complete immotility occurred on the average in 13 days when semen was stored at 4° C. In comparison the average viability time from September, 1949, to January, 1950, was 20 days.

Table III

Viability of Semen

	Days		Days
May, 1949 ...	8·6	October, 1949...	18·2
June, 1949 ...	8·2	November, 1949	23·2
July, 1949 ...	13·5	December, 1949	24·9
August, 1949 ...	16·9	January, 1950...	30·2
September, 1949	19·0	February, 1950	29·0

From 1949 onwards, records were kept to show the conception rate of semen used at various ages. From June to September the Shorthorn semen produced an over-all conception rate 14 per cent. higher than the Guernsey semen, yet for the first four hours of life it was only 6 per cent. higher. From four to ten hours, however, it maintained its original level, whereas the Guernsey semen rapidly fell away. During the second day the Shorthorn semen still gave satisfactory results but the Guernsey semen gave very poor results. During this period relatively few inseminations were carried out with Friesian, Jersey and Ayrshire semen and the figures are consequently not significant.

Table IV

Month	Breed	Age of semen in hours 0–4	4–10	24–28	28–34
June–Sept.	Shorthorn	66·7	68·1	60·0	47·1
	Guernsey	60·7	49·8	31·9	28·7
	Friesian / Jersey / Ayrshire	54·9	56·4	47·5	45·7
Oct.–Dec.	Shorthorn	71·4	72·5	—	—
	Guernsey	72·8	76·8	—	—
	Friesian / Jersey / Ayrshire	73·7	70·7	54·1	68·9

In October, November and December, 1949, however, not only was the fertilising power of the semen improved during the first four hours but was maintained or increased from four to ten hours. During this period Shorthorn and Guernsey semen was used only for one day and no figures can be quoted for the second day. The Friesian, Jersey and Ayrshire semen, however, was used on the second day and, although the conception rate obtained on this day was lower than that obtained on the first day, it was nevertheless satisfactory.

Following the marked fall in conception rates experienced in March, 1948, many attempts were made to discover the cause and to overcome the lowered fertility. These included:—

1. Change of source of diluent.
2. General overhaul of aseptic precautions and technique both in regard to collection, dilution and storage of semen and in insemination.
3. Independent enquiries by experts into the whole of the technical procedure of the centre, the system of bull husbandry, the collection of semen, its handling and its use. Clinical examination of all bulls.
4. Bacteriological examination of the semen of all bulls.
5. Addition of sulphanilamide to diluent.
6. Use of eggs obtained from a different source.
7. Use of low dilutions.
8. Alteration in rations fed to bulls.
9. Administration of vitamins A, C and D to bulls.
10. Administration of luteinising hormone to bulls.
11. Administration of phosphorus to bulls both by injection and *per os*.
12. Administration of P.M.S. to bulls which were slow.
13. Further alterations of rations fed to bulls in an attempt to achieve a Ca/P. ratio of 1: 1.
14. Introduction of changed system of bull husbandry instituting regular rest periods and reductions in "collections."

1. *Change of source of diluent.*

The fall of conception rates in March, 1948, occurred at a time when a change was made in the source of supply of the citrate solution used for the dilution of semen. Up to and including February, 1948, sodium citrate had been obtained from Firm "A", but at the end of February, sodium citrate was purchased from Firm "B". It was not appreciated until the end of April that a fall had occurred in the March conception rates but, immediately this was realised, further supplies of sodium citrate were obtained from Firm "A" and put into use in the middle of May. It was thought at that time that this would rectify the position. It was found, however, by July that there had been no improvement.

2. In July and August the technique of all inseminators was checked and particular attention was paid to the sterilisation of equipment, technique of collection, dilution and handling of semen. Also, the form of sterilising glassware and rubberware was changed. It had previously been the practice to wash all glass- and rubberware in liquid Deosan Detergent, prior to washing with alcohol and placing in a hot air steriliser. The use of the Detergent was discontinued and in its place soap and water was used, followed by clean water and finally alcohol. Following this treatment, all glassware was placed in a hot air steriliser as usual, which was kept at 85° C. Rubberware was placed in a current of hot air and dried for 24 hours. These measures did not result in any improvement in the fertilising power of the semen.

3. An enquiry into technical measures adopted and a thorough clinical examination of all bulls was carried out by Mr. J. L. Hancock, M.R.C.V.S. The former yielded no result; the latter revealed certain minor abnormalities in individual bulls but no general condition of abnormality or disease throughout all the bulls. Stained smears of semen were sent to Mr. Hancock for examination. He reported the presence in practically all samples of a large percentage of curved mid-pieces. At a later date, samples of semen were sent to Mr. Hancock and he himself prepared the smears, in which he found a very much lower percentage of these forms. Further work was then carried out at Lyndhurst to determine whether, or not, a reduction in the number of curved mid-pieces occurred with age of semen. Smears were, therefore, made immediately after collection and, thereafter, at 15-minute intervals and it was found that reduction did occur over the first 45 minutes. The percentage of curved mid-pieces varied considerably between individual collections and individual bulls, but the average percentage found immediately after collection was 20 per cent. with a range of 3 per cent. to 40 per cent. and the average percentage found after 45 minutes was 10 per cent. with a range of 0 to 20 per cent.

Semen collected from newly purchased bulls a day or two after their arrival at the centre showed the same picture and, as yet, it has not been possible to find any correlation between the percentage of these forms and the fertilising capacity of the semen, except in the case of one bull which showed 80 per cent. or more curved mid-pieces in all collections and had low fertilising capacity.

4. Samples of semen from all bulls were submitted to the Wellcome Foundation at Frant, but in no sample were pathogenic organisms recovered.

5. During September, 1948, 0.3 per cent. of sulphanilamide was added to the diluent and a controlled experiment was carried out with this diluent and diluent containing no sulphanilamide. There was no significant variation in the conception rates obtained.

6. In September, 1948, samples of citrate and eggs were sent from Lyndhurst to Mr. J. L. Hancock, of the Burroughs Wellcome Foundation, Frant, and he carried out a controlled experiment on the keeping qualities of semen collected at Frant diluted in a dilutor made up from Lyndhurst eggs and citrate against semen diluted in a dilutor made up from Frant eggs and citrate. He found no significant difference. A controlled experiment was also carried out at Lyndhurst with semen diluted in:—

(a) Egg yolk citrate made at Lyndhurst from Lyndhurst eggs and citrate.
(b) Egg yolk citrate made at Frant from Lyndhurst eggs and citrate.
(c) Egg yolk citrate made at Frant from Frant eggs and citrate.
(d) Egg yolk citrate made at Lyndhurst from Frant eggs and citrate.

In this experiment, semen diluted in (a) appeared to keep longer than in the other three but there was little significant difference.

7. Experiments were carried out at Lyndhurst on the keeping qualities of semen at various dilutions and it was found that semen diluted at 1: 5 in nearly all cases was viable several days longer than semen diluted at 1: 10. In view of this a controlled experiment was carried out in November, 1948, dividing the semen from each of the Guernsey and Shorthorn bulls into two parts and diluting one part 1: 5 and the other part 1: 15. Unfortunately, due to foot-and-mouth disease restrictions, this experiment could be carried out only over approximately 80 cows in

each group and on these numbers there was no significant difference in conception rates, which averaged 66.3 per cent. and 65.7 per cent. respectively. From December, 1948, to April, 1949, the average dilution of all semen was kept below 1 : 10, but this did not result in any increase in the conception rate. As is shown in Table VI the dilution rate was gradually increased after April, 1949, without having any adverse effect on the conception rate.

8. From February, 1945, until the beginning of August, 1948, the rations for bulls were as follows:—

6 parts Ground Oats.
6 parts Bean Meal.
3 parts Fish Meal.
3 parts Ground Linseed Cake.

This was fed at the rate of from 4 to 6 lb. per bull, together with approximately 20 lb. of hay daily. The bulls also had access to a mineral lick and were watered once a day. At the beginning of August, 1948, the concentrate ration was changed and the new ration consisted of:—

9 parts Barley Meal.
3 parts Flaked Maize.
3 parts Ground Linseed Cake.
3 parts Bean Meal.
2 parts Fish Meal.

This was fed at a higher rate, to give an equivalent protein intake with a greater quantity of available starch. Access to mineral licks was also given. On this ration the bulls became slow to work and soft in condition and the original ration was reverted to at the beginning of October, 1948. There was no improvement in conception rates in August or September.

9. In March, 1949, eight bulls were subjected to a course of vitamins A and C by injection and vitamin D by addition of cod liver oil to the dry foods, but this group showed no improved fertility over the other bulls.

10. At the end of March and the beginning of April, 1949, three bulls were each given four doses of 1,000 I.U. of luteinising hormone at five-day intervals with no apparent benefit.

11. Also in March eight bulls were given injections of organic phosphorus on four successive days which was supplemented by acid sodium phosphate *per os* on seven successive days, with no signs of subsequent improvement.

12. Two bulls which were slow to work were subjected to a course of P.M.S., but this did not seem to improve the condition.

13. In April, 1949, a feeding experiment was put into operation in which half the bulls were maintained on the normal ration and half on a ration devised to provide a calcium/phosphorus ratio of approximately 1: 1. There was no significant difference shown in the fertilising capacity of semen from each group but it was found on actual analysis of the ration that the desired ratio had not been achieved, it being 1.6 : 1. The main factor varying the ratio was apparently the hay which, being purchased from merchants, is of necessity variable in quality and type over wide limits.

14. On June 22nd, 1949, following a conference in London, called as a result of the complete failure of all other means taken to effect an improvement in conception rates, Mr. G. N. Gould, M.R.C.V.S., the consulting veterinary surgeon to the centre, recommended radical changes in bull husbandry and technical measures designed to reduce the work of the bulls while maintaining the work of the centre and to reduce drastically the number of ejaculates collected.

It was found from records available that the average number of ejaculates per bull was as follows:—

Table V

			Per cent.
1945 (11 months)	42 ejaculates.	Average conception rate	73·1
1946 ...	52 "	" "	71·9
1947 ...	110 "	" "	68·5
1948 ...	177 "	" "	56·5
1949, Jan.–June	83 "	" "	56·2
1949, July–Dec.	40 "	" "	65·9

It was recommended that each bull should receive one month's rest in four and that, while working, the number of ejaculates at each collection should be reduced to a minimum.

Each bull at the centre received one month's rest during the period July to September, 1949, and to make this possible semen was purchased from other centres. Although this semen had to be transported approximately 100 miles by rail, it produced a higher conception rate than semen obtained from the bulls at Lyndhurst.

It was also recommended that separate premises be taken so that resting bulls would be free not only from physical work, but from the natural stimulation of seeing other bulls at work. A delay of several months occurred before this part of the plan could be put into operation in its entirety, but during July, August and September, 1949, all bulls underwent a rest period of one month at the centre. In November, 1949, the additional premises were completed and this part of the recommendations was put into operation. The restricted buildings at the centre in any case necessitated additional accommodation for the new bulls which it was necessary to purchase to maintain the programme advised.

Following the month's rest each bull was brought back into use and placed on a restricted programme of ejaculates with avoidance of all stimulation and frustration methods of collection. The number of ejaculates at each collection was reduced to a minimum and the bulls were not used more often than once every five days. If the density and motility of the first ejaculate were good, no further ejaculates were taken, and the one ejaculate was used irrespective of the subsequent dilution required to obtain the requisite volume of diluted semen. If the first ejaculate was of poor quality, a second might be taken but, under no circumstances, any more. The reduction in the average number of ejaculates and the subsequent increase in dilutions are shown as follows:—

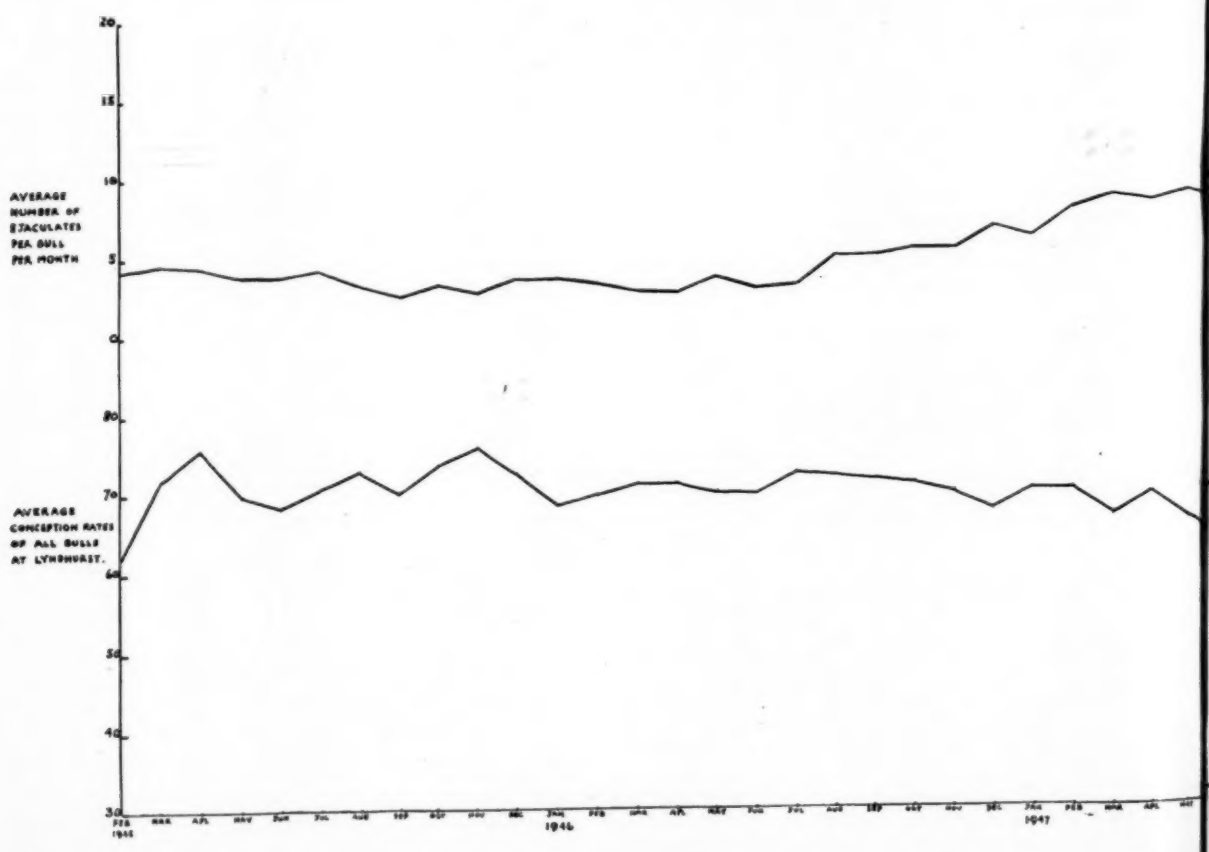
Table VI

Month		Average number of ejaculates per month	Average dilution	C.R. per cent.
1949				
February		15·1	7 0	49·3
March		17·0	8·7	54·0
April, May, June	Seasonal reduction due to reduced demand for semen	14·2	10·0	54·0
		10·8	12·1	51·3
		9·3	14·5	54·8
July	Planned reduction in ejaculates	7·5	18·8	49·1
August		6·7	19·0	52·6
September		6·4	22·5	57·7
October		7·5	22·5	69·0
November		6·8	26·8	70·7
December		6·2	37·2	70·8
1950				
January		5·4	34·6	69·0 (predicted)
February		5·6	36·6	69·0 (")
March		5·1	31·5	70·0 (")

The graph shows the monthly conception rate of all bulls at Lyndhurst and the average number of ejaculates taken per month from each bull. It will be seen that during the period February, 1945, to November, 1946, the conception rate averaged over 70 per cent., and the average number of ejaculates per bull per month was five or under. From November, 1946, to November, 1947, the average number of ejaculates rose from five to ten per month and the average conception rate dropped to 68 per cent. From January, 1948, until April, 1949, the average number of ejaculates per bull per month was between ten and 20 and the conception rate fell as low as 49.3 per cent. There was a rise in the conception rates during November, December, 1948, and January, 1949, but this was not up to the high level obtained before February, 1948, and was not maintained. This latter period was interrupted after the first three weeks by an outbreak of foot-and-mouth disease in the area and the bulls had an enforced rest period of three weeks. The graph shows the rate of work prior to and subsequent upon this rest period. From July onwards the number of ejaculates per month was reduced as planned and the conception rate started to rise in September and by October had attained the level of the period between December, 1946, and February, 1948. It will be seen that the level of work done by the bulls is also comparable to that period.

This report indicates strongly, therefore, that the fertility of a bull can be influenced to a large degree by the amount of work to which he is subjected. The present standard of work at Lyndhurst is one ejaculate every five or six days, with a maximum of eight ejaculates in one month. Each bull has a rest period of four weeks in every period of 16 weeks. It is considered, in view of past experience, that it is dangerous to exceed this rate of work. It is not yet known whether the interval of five days between collections is the optimum one and it is possible that a longer interval would provide improved results. In order that the number of ejaculates could be reduced it was necessary greatly to increase the rate of dilution, but this increase did not reduce the fertility of the semen.

April 6th, 1950. G. H. Bennett, M.R.C.V.S.



Professor Weipers' Visit to the U.S.A.—The Economic Co-operation (Marshall Aid) Administration announces that Professor W. L. Weipers, director of veterinary studies at Glasgow University, is now in the United States for two months of study with experts in his field in the U.S. Department of Agriculture and in State colleges.

The main object of Professor Weipers' visit is to study the nature and scope of U.S. research programmes on the subject of calf diseases with a view to possible expansion and improvement of similar research programmes in the United Kingdom.

Professor Weipers' visit is part of the Marshall Plan technical assistance programme which makes it possible for European technicians to confer with their American colleagues on subjects which will further European industrial and agricultural production.

VETERINARY SURGEON S ACT, 1948
Supplementary Veterinary Register

The Council of the Royal College of Veterinary Surgeons has directed the Registrar under the above Act to register in the Supplementary Veterinary Register the names of the persons set out below.

This is the sixth list of registrations and the absence of the name of any person who has made application in prescribed form before the prescribed date does not imply that such applicant has been refused registration.

The sixth list consists of further persons in whose cases the Council are satisfied that the requirements of the Act have been met.

The date of registration is Tuesday, August 15th, 1950.

Further lists of registrations in the Supplementary Veterinary Register will be published.

Sixth List of Registrations

Names and Places of Practice

BLUM, Leopold, 32, Grosvenor Crescent Mews, London, S.W.1.

DORLING, James William, 45, Fleetwood Avenue, Westcliff-on-Sea, Essex.

HICKMAN, Miss Joan, 146, Marlborough Avenue, Hull.

HINDLE, Roy, 2, Railway Approach, Chertsey, Surrey.

HORNE, Leonard, 221, Barnsley Road, Sheffield, 4.

HUNT, William, 25, Penhill Road, Bexley, Kent.

LUDLAM, Henry, 98, West Bar, Sheffield, 3.

MATTHEWS, Herbert George, The Retreat, Rackenford, Tiverton, Devon.

PARKER, Newman Edward, The Retreat, Stonham, Stowmarket, Suffolk.

PIKE, Eric Thomas, 73, Pleckgate Road, Blackburn, Lancashire.

RIDLER, Victor William Frederick, 113, Ranelagh Avenue, Eccleshill, Bradford, Yorkshire.

SANDERS, Charles James, Rockbeare House, Kenton, Devon.

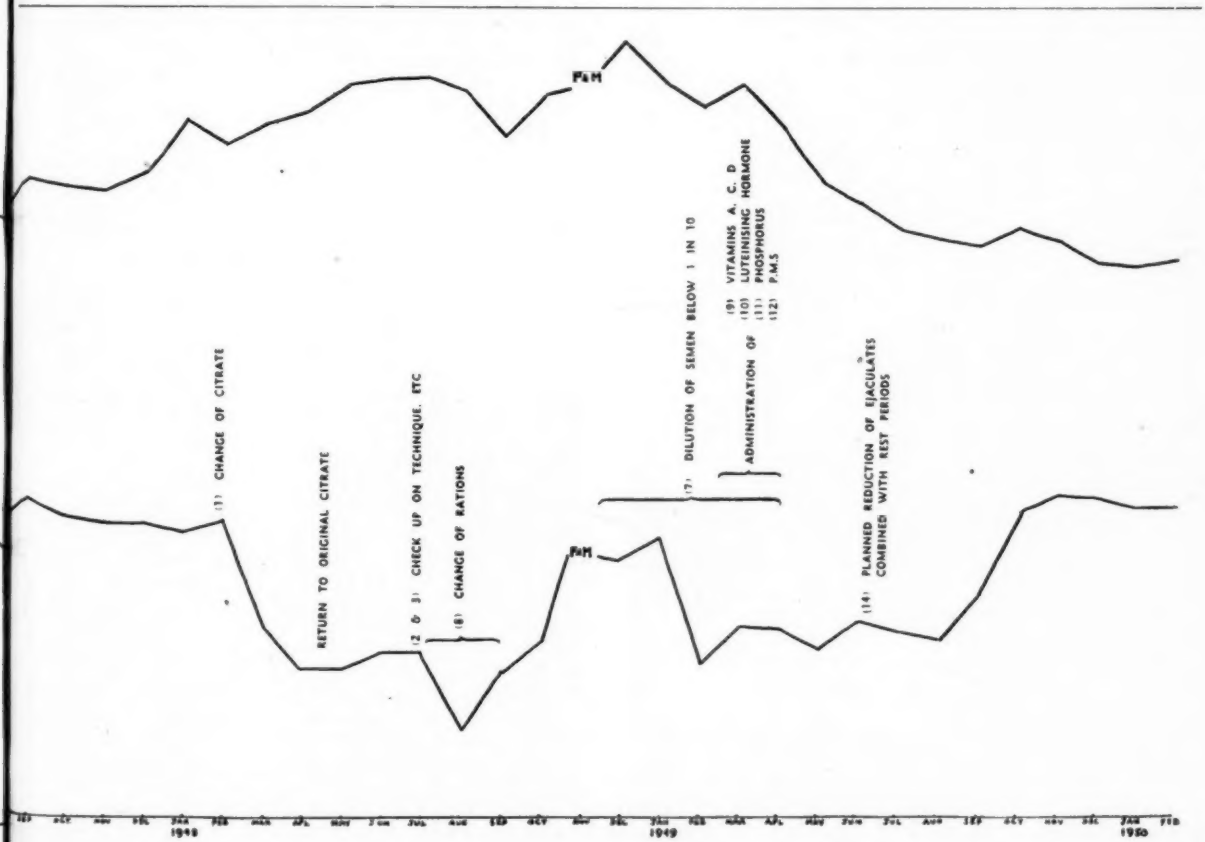
SANDERS, Dudley Charles Lawrence, Rockbeare House, Kenton, Devon.

THOMAS, John James, Penybont, Llansawel, Carmarthenshire.

WALTON, John Septimus Ross, 262, Wylds Lane, Worcester.

WALKER, Robert, 15, Burnock Street, Ochiltree.

WRIGHT, Walter Edward, Brunswick House, Victoria Road, Diss, Norfolk.



β-NAPHTHOXYETHANOL SUSPENSIONS ("ANAVENOL"*): A SHORT-ACTING ANAESTHETIC FOR THE HORSE†

BY

H. B. PARRY

(From the Biological Laboratories, Imperial Chemical Industries Ltd., Manchester, and The Animal Health Trust, Newmarket.)

β-naphthoxyethanol has been known to chemists for a long time, but it is only recently that certain pharmacological actions have come to light during the examination of the compound for anthelmintic activity in the laboratories of Imperial Chemical Industries and which have led to its development as a short-acting intravenous anaesthetic agent in the horse (Francis and Parry, 1949; Parry, 1949).

Personal experience gained on over 300 anaesthesias in more than 100 horses of all types from thoroughbreds to Shetland ponies (full details of which are being published elsewhere) had established that β-naphthoxethanol suspensions ("Anavenol") are sufficiently useful to warrant extended clinical trial. In addition, the substance is of unusual interest in at least three respects. First, the material is injected intravenously as a particulate suspension; second, its action on the nervous system in the horse is one of an *ascending* anaesthesia in contradistinction to the usual *descending* loss of nervous function; and, third, its effect on the nervous system varies considerably in different animal species.

Pharmacology

1. General Properties

β-naphthoxyethanol is a white crystalline powder, only sparingly soluble in solvents which can be administered intravenously. We have had, therefore, to develop suspensions of the compound, the particles of which are 10 to 30μ in diameter. Our observations have been made with suspensions containing 10 per cent. to 20 per cent. of β-naphthoxyethanol in an aqueous vehicle. The standard suspension now contains 10 per cent. w/v of β-naphthoxyethanol and is called "Anavenol." All doses cited in this paper are computed in terms of this standard suspension, which is a rather viscous white fluid.

As far as we have been able to determine, administration of the vehicle alone has no clinically detectable effect in the horse.

2. General Effects After Intravenous Injection of the Suspension in the Horse

If the suspension be injected intravenously (usually into the jugular vein) in the standing horse, so that a dose of 30 to 50 mg. per kg. of β-naphthoxyethanol is given over a period of 80 to 120 seconds, the animal becomes unsteady on its legs towards the end of the injection and shortly afterwards subsides quietly to the ground, often with transient extension of the limbs. It will sit up in sternal decubitus, but if its head is restrained it will lie on its side quietly. There is no response to minor surgical interference of the limbs, although the head and neck righting reflexes, the visual and auditory reflexes are functionally intact. The animal will regain its feet unaided in about 15 minutes without any struggling during recovery.

If, once the animal is recumbent, the injection be continued until 90 to 100 mg. per kg. of the drug are administered, the head and neck righting reflexes, the eye reflexes and hearing are all abolished and the animal appears to be completely unconscious. There may be some spasticity of the limbs. Anaesthesia of this depth has been maintained for as long as two hours and allows section of the large peripheral nerves with very little movement. Recovery from this depth requires 30 minutes.

There is little or no effect on the blood pressure and blood clotting time in the horse, but in some animals, especially if repeatedly anaesthetised with the drug, there is a shift of fluid from the intravascular to extravascular sites, which is shown by a haemoconcentration and some oedema of the muzzle, which is most marked if a twitch has been applied recently. In a few animals a yellow discoloration of the mucous membranes and a deep brown urine may be observed; these signs are due to a coloured breakdown product of the drug.

3. The Possible Action of the Drug.

The drug probably acts first on multi-neuronal sensory and motor circuits in the spinal cord; later, with higher concentrations, the higher brain centres and smaller spinal circuits involving two or three neurones only are affected. There is no curare-like action on myoneural junctions. The analgesic action of the drug is well marked even at low blood concentrations, *i.e.*, when the anaesthesia is very light.

4. The Effects of the Suspension in Animals Other than the Horse.

In the horse the suspension produces anaesthesia without any excitement during induction or recovery and the danger of apnoea during injection is relatively small. In other species, however, these fortunate effects do not occur. In ruminants the apnoea occurs so readily that it is extremely difficult to induce even light surgical anaesthesia, except in young animals under three months of age. In dogs and cats there is marked excitement during induction and it is extremely difficult to pass beyond this stage. In pigs, however, although the danger of apnoea is greater than in the horse, it is possible to induce satisfactory surgical anaesthesia, which one can also do in the fowl.

5. Metabolism of the Compound

The anaesthetic effect of β-naphthoxyethanol is linked very closely with the blood levels of the drug. However, the drug disappears very rapidly from the blood stream and it is essential to maintain adequate blood levels to obtain anaesthesia. A level of 6 to 8 mg. per 100 ml. provides light to moderate surgical anaesthesia, while blood levels of 10 to 13 mg. per 100 ml. are necessary for deep anaesthesia. After a single injection the blood level falls below the anaesthetic level within some 10 to 20 minutes, depending on the size of the injection. It is therefore necessary to maintain or repeat injections if anaesthesia is required for longer than about 15 minutes. For a similar reason no anaesthesia has been obtained by intraperitoneal injection.

The fate of the compound in the animal body has been determined only in part. Some 20 per cent. appears in

* The 10 per cent. aqueous suspension of β-naphthoxyethanol is known commercially as "Anavenol" (trade mark of Imperial Chemical (Pharmaceuticals), Ltd.).

† The substance of this paper was presented to the Society of Women Veterinary Surgeons on May 27th, 1950, and to the Southern Counties Veterinary Association on May 31st, 1950.

the urine, chiefly as β-naphthoxy-acetic acid with a trace (0·1 per cent.) of β-naphthyl, which may give a brown colour to the urine and discolour the mucous membranes. The fate of the remaining 80 per cent. has not been determined and the problem is complicated by the fact that we have been unable to develop a method for distinguishing β-naphthoxyethanol in the form of the original particles and β-naphthoxyethanol which has passed into solution.

6. Dosage and Therapeutic Ratio

The dose required to induce light anaesthesia for 10 to 15 minutes (the so-called induction dose, I.D.) varies from about 30 mg. per kg. (15 ml. per cwt.) for a heavy horse, to 50 mg. per kg. (25 ml. per cwt.) for a light horse. Provided the rate of injection does not exceed 0·5 mg. per kg. per sec. (0.25 ml. per cwt. per sec.), the therapeutic ratio is at least 5 : 1. Once the animal is recumbent the induction dose may be repeated every 10 to 15 minutes as required, and animals have been anaesthetised experimentally for longer than two hours. To provide deep surgical anaesthesia (the disappearance of the nystagmus which occurs at the plane of moderate surgical anaesthesia), a further I.D. can be given slowly over two to five minutes immediately the animal becomes recumbent. Anaesthesia has been induced by this drug three times in one day and over 20 times in the same animal over a period. The hazards from re-inducing anaesthesia immediately or shortly after recovery appear to be not much greater than with the original induction. If the drug be administered very rapidly, *i.e.*, an I.D. in 20 to 25 seconds, at four to five times the recommended therapeutic rate, sudden respiratory arrest will occur, and the drug can be used as a convenient euthanasia agent in this way.

7. Toxicity.

The toxic actions of β-naphthoxyethanol are very largely related to the rate at which the suspension is injected. These fall into two categories, immediate and remote. *The immediate reactions* may be respiratory or cardiovascular. *The respiratory signs* are short periods of apnoea, which indicate the drug has been administered too fast, and which normally quickly disappear. In the horse this apnoea is probably not a great hazard. If, however, the minimum anaesthetic dose of 30 to 50 mg. per kg. be given in 25 seconds instead of 120 seconds, death from sudden respiratory arrest will almost certainly occur. *The cardiovascular signs* are due to the immediate effect of the drug on the heart itself. There may be either a large positive jugular pulse with tricuspid regurgitation, probably due to the temporary dilatation of the muscular ring of the right atrio-ventricular orifice. If such a jugular pulse develops the injection should be slowed or discontinued for 15 to 20 seconds. The other immediate effect on the heart is to produce a tachycardia, which, if the injection be pressed, may proceed in animals with a poor cardiac reserve to ventricular fibrillation. The signs are associated with changes in the electrocardiogram (E.C.G.) involving a shift in the S-T segment and marked changes in the T wave. However, these effects disappear within half to one minute of stopping the injection, and are indicative that the injection rate has been too rapid for the particular subject. This reaction is seen particularly after two or three injections. *With normal rates of injection no changes in the heart or E.C.G. can be detected* (Steel, 1949).

The remote effects of the suspension occur on recovery and are also respiratory or cardiovascular. *The respiratory effect* is shown by an increased rate of respiration, which may become almost dyspnoeic. However, this has always subsided within a few hours. *The remote cardiovascular effects* are similar to those seen with any general anaesthetic in the horse and are due to the onset of cardiac decompensation when the animal attempts to regain its feet. In animals with a poor myocardium this effort, following upon the effects of the drug, may lead to irreversible cardiac failure with death, either from sudden forward failure, or left backward failure with progressive pulmonary oedema and terminal asphyxia.

A number of animals, which have been repeatedly anaesthetised with these suspensions, have been submitted to a thorough pathological examination. No evidence of embolism and permanent damage to small blood vessels has been found.

The suspension is non-irritant when injected outside the vein. Quantities of 20 ml. have been injected subcutaneously at one site; a mild oedematous non-painful swelling develops over 24 hours and subsides within three to seven days without treatment. Even after the wall of the jugular vein has been traumatised severely by the injection needle and the suspension injected outside the vein, no sloughing has been encountered, although the oedematous reaction requires longer to subside. In no case has any treatment been necessary.

8. Combination with Other Anaesthetic Agents

The "Anavenol" suspensions can be combined satisfactorily with many of the anaesthetic agents commonly used in the horse without any special hazards, other than those attending the use of these agents alone. After induction with "Anavenol," anaesthesia can be continued with chloroform by inhalation or chloral hydrate intravenously. Either chloral hydrate or various barbiturates and thiobarbiturates can be administered with the "Anavenol" suspension for induction and maintenance. (Solutions of these drugs should not be mixed with the "Anavenol" suspension). Chloral hydrate by mouth is a useful form of premedication in certain subjects. In these cases the descending central depression of chloral or barbiturate is added to the ascending spinal depression of the β-naphthoxyethanol.

The Clinical Use of "Anavenol" in the Horse

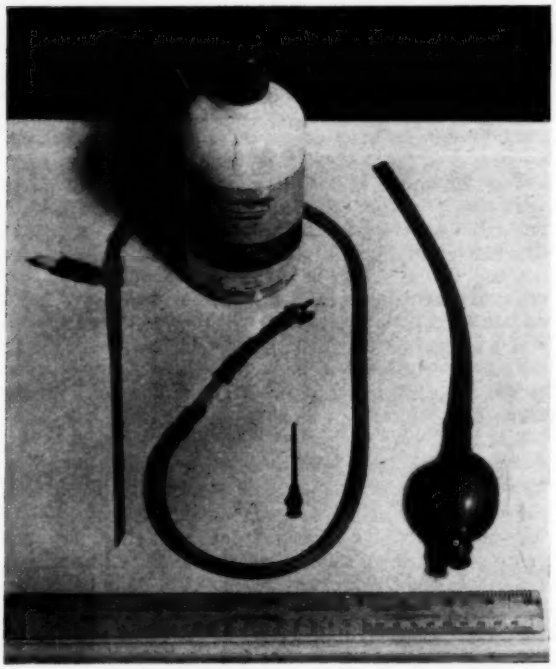
1. The Subject

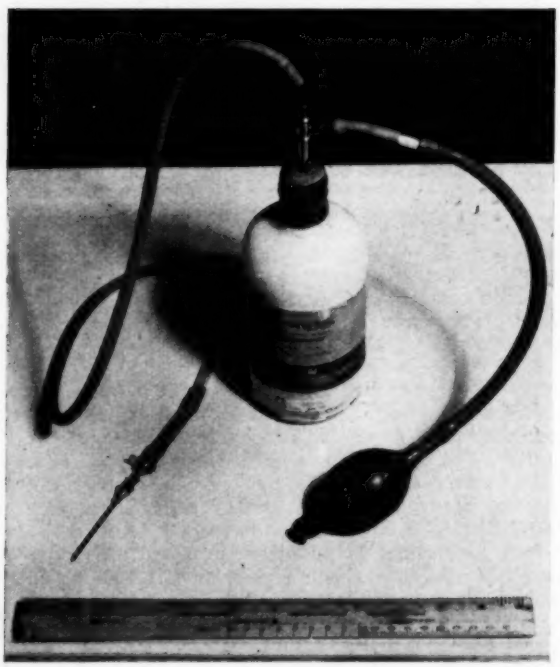
"Anavenol" has been used to anaesthetise more than 100 horses, thoroughbreds, steeplechasers, hunters, hacks, Army "rides," Cavalry horses, Shire, Clydesdale, Percheron and half-bred draft horses, Shetlands and other ponies. They were of various types, ranging in age from one to 30 years and in weight from 50 to 750 kg. (1 to 15 cwt.). One in-foal mare was anaesthetised three times during pregnancy, including once 14 days before normal parturition, and her foal was anaesthetised on several occasions when two to 28 days old without any undesirable sequelae. The horses have not been prepared in any way, except in the case of corn-fed animals which have not been given a heavy corn feed within four hours of the anaesthetic; those at grass have been caught and anaesthetised within 15 minutes. It seems undesirable to starve animals for 24 hours prior to anaesthesia, unless required for surgical reasons.

2. The Apparatus Required

It is almost essential to have some form of positive

pressure injection apparatus for the intravenous injection of the suspension. Various forms of gravity apparatus, etc., are not usually satisfactory and in our hands the most convenient apparatus is that shown below. The suspension is available in bottles of 500 ml. capacity, fitted with a rubber diaphragm cork. If a Willows' injector, such as is used for milk fever therapy, is inserted through the cork,





an enema pump attached to the air inlet and a piece of stout rubber tubing 2 feet to 3 feet in length attached to the outlet with a two-way stop-cock with a record mount at the end, the bottle can be discharged in the upright position when placed conveniently in the breast pocket of an overall. The needle has been of Record pattern 12 gauge with 2-inch shaft, and the author personally finds a Willows' butt a convenient size for his hands. Various forms of larger needles and trochars and cannulae have been tried, but none of them has proved to have any conspicuous advantages over the simple needle which, if kept sharp, is readily inserted upwards into the left jugular vein with the right hand, while the left thumb tenses the skin downwards and raises the vein. In highly strung horses the needle is inserted through a wheal of local anaesthetic, but for the great majority of cases this would appear to be an unnecessary refinement in practice.

3. Technique of Administration

The method adopted has been to induce anaesthesia from the standing position and then deepen the anaesthesia as required, once the animal has become recumbent. Wherever possible the anaesthesia is done in the open, on grass with a slight slope, with the animal facing downhill, but it can be carried out perfectly well in a loose-box, if necessary. For induction the horse with a well-fitting bridle, headstall or halter is held quietly by one man. Occasionally a blind is of value. In fidgety animals it may be necessary to apply a nasal or ear twitch, but these have been used only as a last resort. It is important to carry out the injection as quietly as possible and we have found that once the needle has been inserted we have rarely had any further difficulty. The dose of 30 to 50 mg. per kg. required for induction, details of which are given in Table I, is administered against a watch over a period of one and a half to two minutes. Some animals tend to become unsteady on their feet before this amount has been injected, in which case the final quantities are given more quickly; in other cases, an animal may require more than the estimated dose and this is also given more quickly towards the end of the two minutes. No precise dosage can be given, but the anaesthetist has some indication of the course of the induction by " mouthing " movements of the jaws and by a slight swaying of the hind quarters. As soon as this swaying becomes pronounced, the apparatus is disconnected and the man on the horse's head forces the animal to take a sharp step backwards, at the same time bringing its nose round to the shoulder opposite to the side on which it is desired that the animal shall lie. This sharp step backwards is usually all that is necessary to induce the animal to fall quietly backwards to the ground, when *its head must be restrained at once*, otherwise the animal will attempt to sit up in sternal decubitus. By suitable head restraint it is possible to control an animal even when the anaesthesia is very light indeed. The important point is to keep the lower jaw as dorsal relative to the thorax position as possible. This is achieved conveniently by a man kneeling lightly with one knee on the animal's neck while the animal's nose is held back against the man's body, or, in restive horses, rests against the thigh of the other leg, the foot of which is placed flat on the ground. Once the animal is down the injection can be continued as required to give any required depth of anaesthesia. It is helpful to place a pillow underneath the neck so that the nose is downhill, a procedure which brings the jugular vein into a convenient position for further injections and allows the nasal discharge, which may accumulate, to drain away readily.

4. Depth and Duration of Anaesthesia

The anaesthesia likely to be obtained with any given dose of " Anavenol " is given in Table I. With an induction dose of 30 to 50 mg. per kg. (15 to 25 ml. per cwt.) one will usually obtain light (plane 1) surgical anaesthesia for about ten minutes, when the animal will sit up and five minutes later regain its feet. If, as soon as the animal is recumbent, a further dose, similar to the induction dose, be given immediately, the animal will pass into moderate (plane 2) surgical anaesthesia and will not sit up for 20 to 25 minutes. A larger dose will induce deep anaesthesia. If, when the animal is about to sit up, it be given a further injection similar to the induction dose, anaesthesia may be prolonged for 10 to 15 minutes. Probably the most satisfactory method, if an anaesthetist is available, is to give a slow continuous infusion of the suspension for, by this method, it is possible to obtain a high degree of control over the depth of anaesthesia from minute to minute and to allow a lightening of anaesthesia as the operation nears completion. This is possible owing to the pronounced analgesic effect of the drug, even at very low blood concentrations. In this way an anaesthetised animal may sit up as soon as the stitches have been inserted and will normally regain its feet 10 to 15 minutes later. The maximum dose which should be given on any one occasion should not exceed 100 mg. per kg. (50 ml. per cwt.). If circumstances demand it, an animal may be re-anaesthetised as soon as it regains its feet or later the same day, without markedly increasing the hazards for a normal animal, although this procedure is undesirable.

The sequence of changes in ocular reflexes and movements differs considerably from those encountered with most anaesthetics. Thus the usual evaluations of corneal and pupillary signs are not reliable guides to the depths of anaesthesia with " Anavenol." Better to observe the horizontal nystagmus which develops in plane 2 surgical anaesthesia and disappears when plane 3 is attained.

Table I

Approximate Dosage Table for 10 per cent. w/v Suspensions of " Anavenol "

(injected at rate of 0.5 mg./kg./sec. or about 1 ml./sec.)

Animal			Induction Dose		
Type	Weight Range				
	cwt.	kg.	ml.	gm.	mg./kg.
Heavy draft ...	10-20	500-1,000	150-250	15-25	30-25
Thoroughbred, Hunter, Hack	8-10	400-500	120-160	12-16	35-30
Cob, Vanner ...	7-9	350-450	100-150	10-15	40-35
Pony	4-6	200-300	80-120	8-12	50-40
Animal under 1 year	1-4	50-200	30-100	3-10	60-50

5. Recovery and Convalescence

In many cases the animal will sit up quietly in sternal decubitus and will not attempt to rise to its feet until able to do so unaided. However, it is a wise precaution to have some attendant ready in case an animal does attempt to get up before being able to stand without assistance. Usually all that is required is a firm hand on the head and a little steadying on the tail. Old animals and those with cardiac weakness should not be allowed to make repeated ineffectual struggles to gain their feet, because the additional strain on the cardiovascular system may prove sufficient to provoke acute cardiac failure, a sequel which is liable to occur at this stage with any general anaesthetic. In many cases there is a fine trembling of the limb muscles when the animal first stands up.

Post-anaesthetic convalescence is usually quite uneventful. In many of my own cases, animals lying out, which have been anaesthetised during bad weather in winter, have not been housed after anaesthesia. In a small proportion of animals there may be some sweating and a period of rapid shallow breathing lasting several hours, which disappears spontaneously; such cases should be housed overnight after anaesthesia if the weather is inclement.

The Evaluation of " Anavenol " for Surgical Anaesthesia in the Horse

The early pharmacological studies of " Anavenol " were sufficiently encouraging to warrant an evaluation of the therapeutic efficacy of the drug in surgical practice. Through the generous co-operation of the Director-General of the Royal Army Veterinary Corps, and the Officers Commanding at the Corps' Melton Mowbray Depôt, and several practising veterinary surgeons, it was possible to assemble 58 consecutive surgical horse cases, in which " Anavenol " was used as the sole anaesthetic agent. (A detailed account of these observations is being published elsewhere.) Anaesthesia was induced in all cases in the standing position, usually with a bridle and a halter only and occasionally a twitch.

1. Type of Case

The series comprised four thoroughbreds, 29 hacks or rides, 18 heavy horses, one in-foal mare, five ponies, one two-day old foal. They varied in age up to 26 years, the majority being 10 to 14 years, and in weight from 50 to 600 kg. (1 to 12 cwt.), but mostly 400 to 500 kg. (8 to 10 cwt.). They were anaesthetised without any special preparation. The surgical interference included operations for teeth extraction, trephining the frontal sinus, quittor, canker and grease, hoof-grooving, seedy toe, hoof resection, pin-firing, ventriculectomy, partial rig, castration, removal of cutaneous and mammary tumours, opening abscesses, exploration of open hock joint, sinus of the mane, curetting wounds, etc.

The technique of administration was in all cases to give an induction dose in the standing position, and, once the animal was recumbent, to give more as required. The total dose never exceeded 100 mg. per kg. (50 ml. per cwt.).

2. Results

Induction was excellent and without any excitement whatever in all cases, except in one animal, which on the first occasion resisted all attempts to anaesthetise it. However, on a second occasion, after 30 gm. (1 oz.) of chloral hydrate had been administered by stomach tube one hour before, satisfactory anaesthesia was obtained with a dose of " Anavenol " considerably less than that given on the first occasion. In general, induction was very much quicker where the animal had been kept quiet; once animals had become excited it was sometimes difficult to obtain an adequate depth of anaesthesia, particularly if the animal was of an aggressive type.

The Depth of Anaesthesia was usually deep plane 1 to deep plane 2 surgical anaesthesia. The aim was to provide an anaesthesia just deep enough to allow the surgeon to carry out his interference without any restraint of the limbs, apart from that required to maintain a given surgical

posture. This was attained in the majority of cases, particularly in operations on the limbs; pin-firing and hoof-grooving operations would be carried on without any ropes on the limbs. However, occasionally it would be difficult to attain this; in particular in one case of suppurative sinuses of the mane it proved difficult to obtain anaesthesia deep enough to give complete immobility, probably due to an inadequate initial depth of anaesthesia.

The Duration of Anaesthesia varied from 10 to 70 minutes, with an average about 25 minutes.

Recovery from the anaesthetic was quiet and without excitement. Animals would sit up and get to their feet when able to stand. This occurred in all cases in five to 20 minutes after completion of the operation and *post-operative convalescence* was uneventful, except in one case, which dropped dead shortly after regaining its feet.

This one fatality was a heavy draft horse under operation for bilateral ventriculectomy, which proved difficult and required 40 minutes' surgical work. The animal recovered into a sitting position normally, but when attempting to regain its feet, its shoes, fitted with calkins, slipped repeatedly on the stone floor. After some 20 minutes' struggling the animal stood up with some assistance, only to collapse a few minutes later and die very quickly. The autopsy showed a dilated heart with evidence of recent gross over-distention, especially of the thin right ventricle. An analysis of the pre-operative history strongly suggested the presence of cardiac insufficiency at work, in addition to the "roaring," although the former was not obvious at rest. Death was almost certainly due to sudden cardiac decompensation brought on by the severe exertion when trying to regain its feet, in an animal which had a poor cardiac reserve resulting from long-standing myocardial weakness. Such an outcome is in line with our experience of simple anaesthesia in horses with cardiac diseases; namely, that horses with a poor myocardial reserve are a bad risk for anaesthesia with β-naphthoxyethanol, as, indeed, they are with any systemic anaesthetic.

Animals with a poor myocardial reserve are normally readily detected by clinical observation of the cardio-vascular system during the course of the anaesthesia, but an animal in a position of dorsal decubitus, such as is used for the ventriculectomy operation, affords the anaesthetist no scope for assessing either pulse or heart beat, so that signs of a poor cardiac reserve cannot be detected and appropriate measures taken.

The surgeons' comments were that they considered the anaesthesia perfectly adequate and in many cases (depending on the anaesthetist's skill) excellent. There was no increase of capillary bleeding, blood clotting was not retarded and post-operative recovery was as good as they would have hoped for with other anaesthetics. Berger's (1949) results in practice confirm these findings.

3. General Comments

In many animals the anaesthesia obtained was so complete that, provided the head was restrained, no movement whatever of the trunk or limbs occurred during the operative interference and one would move between the horse's unrestrained limbs without trepidation. In a small number of cases this degree of control was not obtained, and some movement of limbs occurred, although the anaesthesia was as satisfactory as that often attained with other anaesthetic agents, and wild thrashing movements of the limbs were never encountered. While no one factor seemed to be responsible for this sub-optimal effectiveness of "Anavenol," a number of contributory causes could be discerned. Pre-anaesthetic excitement or disturbance, prolonged induction time, such as when needles become blocked or displaced, disturbances during induction, such as placing side lines in position, an inadequate induction dose administered too slowly, very hot weather, prolonged starvation for more than 24 hours or withholding of water may all affect adversely the precise pattern of anaesthesia obtained and should be avoided wherever possible.

Indications and Recommendations for the Use of "Anavenol"

1. Indications

"Anavenol" should only be used in horses and other equidae and for anaesthesia of short duration. The chief indication for the selection of "Anavenol" as the anaesthetic is in horses which have been handled and where the anaesthesia or restraint required does not exceed 30 minutes. Induction and recovery are so rapid and uneventful that it is perfectly feasible to anaesthetise a horse with an induction dose merely to shoe a difficult animal or to clip out or dress a case of chorioptic mange of the legs, or to effect an unhurried clinical examination of an inaccessible part.

The chief contra-indications are advanced cardiovascular and respiratory diseases, as indeed they are for any general anaesthetic. However, the chief point to be assessed is myocardial weakness, especially of the right side, which may not be obvious on casual clinical inspection. Animals with this defect can be anaesthetised if the weakness is not too advanced, but great care must be exercised, especially if more than the induction dose is given. Horses with valvular disease, such as tricuspid incompetence, can be anaesthetised satisfactorily provided the myocardium is sound, and care is taken to inject the drug more slowly than normal once the induction dose has been given.

2. Recommendations

Induction

It is essential for satisfactory results that a dose adequate for induction in any particular animal be administered intravenously over a period 90 to 120 seconds and definitely not exceeding 150 seconds, as measured by the watch. All anaesthesias should be timed until the anaesthetist is thoroughly conversant with the use of the suspension. After a prolonged injection time an animal is often difficult to anaesthetise satisfactorily. The most satisfactory apparatus which gives the essential control of the rate of injection uses some form of positive pressure. It may be similar to the usual Willows' injection apparatus described above or make use of a large syringe, which can be connected to the "Anavenol" container by a three-way tap in place of the two-way tap, by which the syringe can be rapidly refilled during the injection if necessary.

An experienced man at the animal's head is of great assistance, since the initiation of a sharp backward movement at the crucial moment facilitates very greatly the animal's loss of balance. Once an animal has discerned its unsteadiness and has planted its legs well apart, it can be difficult to get it off its feet.

Depth and Duration of Anaesthesia

Should an operator suspect that an animal may prove difficult to anaesthetise, premedication with chloral hydrate *per os* is helpful. For operations requiring very deep and prolonged anaesthesia a combination with other agents is advisable, and in such cases "Anavenol" may not be

the anaesthetic of choice, apart from induction. The use of " Anavenol " should be confined to operations requiring not more than 30 minutes' anaesthesia.

Signs of Toxicity

The cardiovascular and respiratory systems must be observed closely throughout the administration, for the appearance of toxic signs gives excellent warning that the injection rate has been too rapid. Since no practicable specific antidote for the toxic effects of " Anavenol " is known, it is essential to watch carefully for the onset of these signs. These are very slow breathing or short periods of apnoea, and the more sensitive cardiovascular signs of tachycardia and tricuspid regurgitation with a positive cardiac jugular pulse. If any of these should appear or the heart frequency exceed 120 per minute, the injection should be stopped for a short period. After a minute or so the toxic signs should subside, when the injection can be continued again, but more slowly. These signs have not been observed in normal horses during induction, but they are more apt to appear with each subsequent injection, and normally give ample warning before irreversible changes have been induced.

Summary

1. An aqueous suspension of β-naphthoxyethanol (" Anavenol ") has proved to be a useful equine anaesthetic, worthy of extended evaluation.

2. The pharmacological actions of the drug are described briefly.

3. Directions for the clinical use of " Anavenol " as an anaesthetic in the horse are given.

4. The results of its use for surgical anaesthesia are described.

5. Certain difficulties which may arise in its use are discussed.

Acknowledgments.—I wish to thank Imperial Chemical Industries, Ltd., for permission to publish. I have received much kindly co-operation and valued assistance from colleagues in the Biological and Pharmaceutical Departments of that company, the Director-General of the Royal Army Veterinary Corps, the Officers Commanding and many officers at the Corps' Melton Mowbray Depôt, and a number of practising veterinary surgeons, including J. Berger, of Alderley Edge, J. Adamson, Jnr., of Bolton, and G. N. Greer, of Leigh.

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NATIONAL PIG BREEDERS' ASSOCIATION

With the election of 615 new members total membership of the National Pig Breeders' Association has now reached the record figure of 5,966, it was reported at a council meeting in London recently. Entries for the herd book have increased this year by over 4,000 compared with 1949, the number of litters notified in the same period having increased by over 1,800. A total of 165 pedigree export certificates have been issued this year for pigs of the association's six breeds sold to 13 overseas countries.

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A cable carrying 12,600 volts snapped over a field at Craigrothes, Cupar, Fife, killing nine heifers, the property of Mr. G. Berwick, Barbarafield.

AN IMPROVED FORM OF "ANAVENOL" * : "ANAVENOL"-K—THE COMBINATION OF β-NAPHTHOXYETHANOL WITH THIALBARBITURIC (" KEMITHAL ") † ACID

BY

H. B. PARRY

(From the Biological Laboratories, Imperial Chemical Industries, Ltd., Manchester, and the Animal Health Trust, Newmarket.)

During the work on the use of β-naphthoxyethanol suspensions as an anaesthetic agent (Parry, 1949), it occurred to us that it might be possible to combine the central depressant action of the barbiturates or chloral hydrate with the ascending spinal action of β-naphthoxyethanol and thus provide an anaesthetic agent with a range of usefulness wider than that of " Anavenol " alone. Such a combination, if successful, promised to abolish the head movements and exteroceptive sensibility still present with the small doses of β-naphthoxyethanol necessary for light surgical anaesthesia, without allowing the excellent induction and recovery provided by " Anavenol " to be overwhelmed by the prolonged action of full anaesthetic doses of barbiturates or chloral hydrate.

We already knew that β-napthoxyethanol suspensions (" Anavenol ") could be used successfully in conjunction with various barbiturates and chloral hydrate without any special additional hazards (Parry, 1950). The problem was to select the most suitable drug and determine whether it could be combined satisfactorily with " Anavenol " to give a stable suspension. A number of combinations with barbiturates, thiobarbiturates and chloral were examined, full details concerning which are being published elsewhere. The most promising mixture appeared to be a combination of β-naphthoxyethanol with a short-acting thiobarbiturate, namely, thialbarbituric (" Kemithal ") acid, and the results obtained with this combination will be reported here.

Pharmacology

1. Sodium Thialbarbitone (" Kemithal ") in the Horse

The pharmacology of sodium thialbarbitone (" Kemithal "), the sodium salt of thialbarbituric acid, has been described fully by Carrington and Raventós (1946) and its use in human medicine evaluated by MacIntosh *et al.* (1946). It is a satisfactory agent for anaesthesia of short duration in the dog (Parry, 1948) and the sheep (Titchen, Steel and Hamilton, 1949). In order to establish whether its action was similar in the horse, ten animals have been anaesthetised with intravenous " Kemithal " alone. Induction has been from the standing position using the technique used with " Anavenol " (Parry, 1950).

The induction dose has varied from 20 to 30 mg. per kg. Its administration has been accompanied by some induction excitement, during which the animal has often tried to plunge forward before falling to the ground. With doses of 40 to 50 mg. per kg., plane 2 surgical anaesthesia has been obtained, in which the head and neck righting

* " Anavenol " is the registered trade mark of Imperial Chemical (Pharmaceuticals), Ltd., for the 10 per cent. suspension of β-naphthoxyethanol.

† " Kemithal " is the registered trade mark of the same company for the sodium salt of 5. Δ ^{2} : ^{3}—cyclohexenyl 5 allyl 2 thiobarbituric acid.

reflexes, and ocular and auditory sensibility have been abolished. Periods of apnoea are apt to occur suddenly during the injection, unless the rate is very slow. Recovery has been the least satisfactory feature of "Kemithal" anaesthesia; it is prolonged and, even with minimal anaesthetic doses of 30 mg. per kg., may last as long as an hour, during which time the animal makes repeated attempts to get to its feet, flounders and plunges and requires a great deal of restraint to prevent it damaging itself. Even when the animal does stand up, it may be unsteady for as long as half an hour.

The practical disadvantages of "Kemithal" are the prolonged recovery time, if a full anaesthetic dose is given, and the ease with which apnoea occurs during induction. However, while the animal is recumbent the anaesthesia is very satisfactory.

2. Mixtures of "Anavenol" and "Kemithal" Acid in the Horse

From our experience of "Kemithal" alone, it seemed desirable, if the rapid recovery obtained with "Anavenol" alone were to be retained, that the amount of "Kemithal" should be kept to the absolute minimum required for the depression of higher nervous function. We investigated various combinations and decided that a suspension containing 10 per cent. w/v of β-naphthoxyethanol with 2.5 per cent. w/v of "Kemithal" acid was likely to be most suitable.

This preparation is a particulate suspension very similar to "Anavenol" and supplied in similar containers. Its effect when injected intravenously into the horse is very similar to "Anavenol," with the addition of slight central depression due to the small amount of "Kemithal" acid. The dose of β-naphthoxyethanol required to obtain a given plane of anaesthesia is reduced by about one third.

The head and neck righting reflexes are depressed much more than with "Anavenol" alone. The hyperpnoea seen with "Anavenol" is absent and the post-anaesthetic trembling, sweating and respiratory effects are very much reduced. The mixture is non-irritant when injected extra-vascularly. There would appear to be no additional toxic hazards other than those seen with "Anavenol"; in fact, the therapeutic ratio of this mixture in practice is greater than "Anavenol" alone, since the dose of β-naphthoxyethanol which must be administered is reduced and the amount of "Kemithal" is too small to approach in any measure the toxic level. The chief disadvantage would appear to be a slightly prolonged recovery compared with that seen with "Anavenol" alone; if the total amount of "Kemithal" acid administered exceeds 15 mg. per kg., a floundering recovery is observed, which can be conveniently described as "barbiturate hangover," and persists for about five minutes.

The Clinical Use of "Anavenol-Kemithal" ("Anavenol"-K) Suspensions

1. Subjects and Administration

The suspension has been used for anaesthetising ten animals on some 25 occasions—these have included one thoroughbred, a heavy horse, several light draft horses and ponies. The technique of administration and the results obtained have been very similar to those obtained with "Anavenol" (Parry, 1950), except that the moderate central depression of the barbiturate has been added.

2. Dose and Depth of Anaesthesia

The induction dose has been approximately 10 to 18 ml. per cwt., 20 to 36 mg. per kg., of β-naphthoxyethanol and 5 to 9 mg. per kg. of "Kemithal" acid, *i.e.*, the amount of β-naphthoxyethanol required is about two-thirds of the estimated dose, if "Anavenol" be used alone. This dose reduction holds equally for the deeper planes of anaesthesia. When anaesthesia of longer duration has been induced and the total quantity "Kemithal" acid exceeds 20 mg. per kg., there has been evidence of prolonged recovery and "barbiturate hangover." This has, in certain instances, spoilt the very quiet and rapid recovery obtained with "Anavenol" alone and it would appear desirable not to use the "Anavenol"-K mixture if anaesthesia has to be continued, but to use the simple "Anavenol" alone or perhaps a combination with another anaesthetic.

3. Toxicity

The signs of toxicity are similar to those of "Anavenol" (Parry, 1950). The danger of apnoea during injection is increased slightly, while the hyperpnoea is reduced greatly. Steel (1949) has shown that when "Anavenol"-K is administered at the standard therapeutic rate, no changes in the heart and electro-cardiogram can be detected.

The Evaluation of "Anavenol"-K in Surgical Cases

It has not proved possible to assemble a long series of cases, such as we reported with "Anavenol" alone. Indeed, this would not appear to be necessary, since "Anavenol"-K is but a small modification of "Anavenol." The "Anavenol"-K suspension has been used for castration, simple restraint for clinical examinations, while in some animals, which were not allowed to recover, median and plantar neurectomies, ovariotomy through the flank and intestinal re-section were performed. The anaesthesia was such that these operations were carried out without any movement of the animal's trunk and limbs. In fact, after the first neurectomy, the surgeon was happy to carry out others without any restraint of the limbs at all; the only movement was a very slight movement of the foot, as the nerve was severed.

Comments

"Anavenol"-K would seem to offer certain advantages over "Anavenol" alone for anaesthesia of short duration in the horse. The dose of β-naphthoxyethanol required is about one-third less, while the additional "Kemithal" is but a fraction of the toxic dose. The suppression of the head and neck-righting reflexes makes the restraint of the animal's head easier, the hyperpnoea is suppressed and the animal appears to be asleep as with the other anaesthetics commonly used, and there seems to be less sweating and trembling on recovery, although these were never very serious consequences with "Anavenol."

The main disadvantage is the development of delayed recovery (so-called "barbiturate hangover"), when the total dose of "Kemithal" acid administered exceeds about 15 mg. per kg. If the advantages of the rapid quiet recovery obtained with β-naphthoxyethanol are to be obtained it seems important to restrict the total amount of "Kemithal" acid given. In cases requiring more than an induction dose, this can be conveniently done by induction with "Anavenol"-K and then carrying on the anaesthesia with "Anavenol" alone if this proves necessary.

(Concluded at foot of next column)

A MIXTURE OF β-NAPHTHOXYETHANOL WITH THIALBARBITONE ("ANAVENOL"-K) AS AN ANAESTHETIC IN FARM ANIMALS

BY

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INTRODUCTION

The anaesthetic properties of β-naphthoxyethanol ("Anavenol") have been described by Francis & Parry[1] and Parry[2], and Berger[3] has given an account of its use in practice as a short acting anaesthetic for the horse. These authors, however, state that when used alone "Anavenol" is not suitable for use in ruminants.

In later work Parry[4] found that the addition of a suspension of 2½ per cent. of thialbarbitone ("Kemithal") acid to a 10 per cent. suspension of "Anavenol" enhances its action in equines in many respects and, in particular, by increasing the degree of muscular relaxation produced, especially about the head and neck. "Anavenol" when used alone produces a varying degree of acceleration of the respiratory and cardiac rate and these effects are reduced by the addition of thialbarbitone. In addition, the induction dose of the combined drugs was found to be of the order of two-thirds of that of β-naphthoxyethanol.

We have been able to confirm these findings in the horse in a series of more than 30 anaesthesias in ten animals of varied age and condition and we have concluded that the mixture of suspensions of 10 per cent. β-naphthoxyethanol with 2½ per cent. thialbarbitone acid ("Anavenol"-K) is an excellent anaesthetic for this species.

Our main interest, however, has been in the bovine, in which species there is an equal need for an easily administered anaesthetic which is free from the disadvantages of such agents as chloral hydrate and chloroform.

In a series of 74 anaesthesias in 37 cattle, we have shown that whatever deficiencies are shown by "Anavenol" alone in this species, they are not apparent with "Anavenol"-K, and that this combination may be used with a high degree of safety and for a wide range of surgical operations.

SUMMARY

1. The combination of β-naphthoxyethanol ("Anavenol") with thialbarbituric ("Kemithal") acid ("Anavenol"-K) is described. This mixture would appear to have significant advantages over "Anavenol" alone for anaesthesia of short duration in the horse.

2. Recommendations for its use are similar to those for "Anavenol."

Acknowledgments.—I wish to thank the directors of Imperial Chemical Industries, Ltd., for permission to publish and my colleague, Lt.-Col. J. Hickman, who kindly assisted with the surgical evaluation.

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This paper, therefore, refers in the main to details of our work with "Anavenol"-K in cattle, although some note is made of our experience with horses in this direction.

ADMINISTRATION OF THE ANAESTHETIC

Preparation of the Subject.—It is found that no preparation is necessary before administering "Anavenol"-K, apart from the usually accepted fact that it is better to withhold bulky food overnight, particularly in the case of cattle. When this is not done it is found that some coughing occurs during the operation, and while this is not harmful to the animal, it interferes with the surgical work.

The fact that the cough reflex is not abolished constitutes a definite advantage, since the risk of inhalation of saliva, which is one of those inherent in general anaesthesia in cattle, is minimised.

Restraint.—The absence of struggling and incoordination associated with this agent makes the need for restraint absolutely minimal, one man at the animal's head being all that is required during administration. During the surgical interference no restraint at all is required apart from that necessary to maintain the animal in a convenient position, and on recovery it can be left entirely unattended with complete safety.

Apparatus.—As already indicated, "Anavenol"-K consists of a suspension of particles, and for this reason its consistence is obviously thicker than that of the more familiar solutions commonly used as anaesthetics. Thus administration by gravity is not possible, and some form of positive pressure must be employed. The early part of this work was carried out with one or other of the injectors usually sold for the administration of calcium solutions, but owing to the need for more precise regulation of the rate of injection, Record syringes were later found to be preferable. In animals of about 8 cwt. body weight the volume of the anaesthetic required for induction is usually below 100 c.c., so that a syringe of that capacity is used. Since, however, a larger dose may be required in some individuals, a spare syringe is filled and kept in readiness. The animal of average size usually will start to sway slightly after the administration of some 60 to 75 c.c. and this is found to indicate that a further 20 c.c. or so will complete induction. If this does not occur the syringes are rapidly changed and injection is continued.

Dosage.—As with all anaesthetics it is not possible to state an exact dose of "Anavenol"-K, but in the average animal the quantity required for induction is of the order of 10 c.c. per cwt. body weight. It must be emphasised, however, that quite considerable variation may be experienced not only in different individuals but in the same individual on different occasions. Also, volumes greatly in excess of the average will not induce anaesthesia if injected too slowly. It is therefore of the greatest importance to inject "Anavenol"-K at the correct speed, and to continue the injection until the animal goes down.

If for any reason injection is accidentally interrupted before induction is complete, it is advisable to suspend operations for five or ten minutes and start again from the beginning.

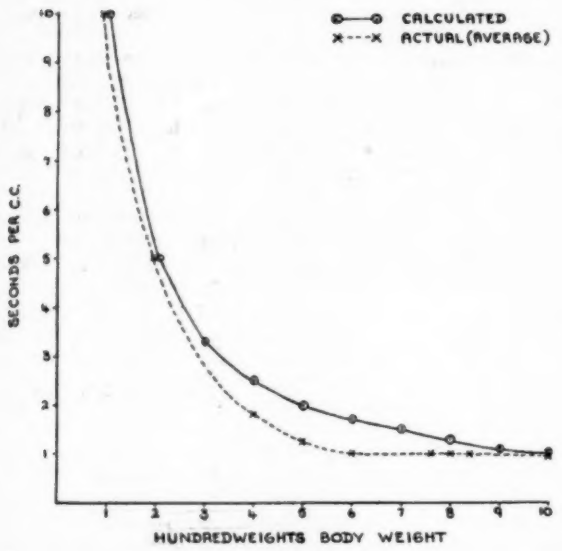
Maintenance doses, the administration of which is described later, are of half the volume of the induction dose.

Rate of Injection.—As stated above, the rate of administration of the anaesthetic is important and if it is too low, anaesthesia may not be produced. Excessively high rates, on the other hand, may produce tachycardia, and, if extreme, respiratory failure.

The correct injection rate is approximately 1 c.c. per second for animals weighing from 5 to 10 cwt. It is, however, very closely related to the body weight for small animals, and may be calculated as 0·1 c.c. per second per cwt. Thus for a calf

weighing 1 cwt. the rate is 1 c.c. in ten seconds, and for 2 cwt., 1 c.c. in five seconds. In very heavy animals, on the other hand, the rate is somewhat increased.

If the injection rate calculated as above is expressed graphically it will be seen that the curve flattens very considerably for animals of 5 cwt. body weight and over and we have found that in practice this flattening of the curve is even more pronounced (see graph). In other words, the injection rate for animals of 5 to 10 cwt. is very nearly constant and since the great majority of animals presented for operation fall into this weight category, injection at 1 c.c. per second will induce safe anaesthesia in the average subject. For very small animals, however, it will be seen that the rate of injection decreases very steeply with the body weight.



Relationship of Rate of Injection to Body Weight

Anaesthesia

Induction and Recovery.—One of the outstanding features of anaesthesia with both " Anavenol " and " Anavenol "-K is the entirely uneventful induction and recovery associated with them. When a sufficient quantity has been injected at the correct rate, the animal sinks gently to the ground following its normal behaviour pattern, the horse going down on its hind legs, and the ruminant on its fore legs. On recovery the animal first assumes the natural sitting position and after a few minutes rises to its feet in a normal manner, and can be led away. After very prolonged anaesthesias a few minutes standing at rest may be necessary, but after a single injection the animal is entirely coordinate. At no stage is the slightest degree of excitement or struggling shown, and no restraint of the animal is required beyond that necessary to maintain it in a suitable position for operation.

Single Dose Anaesthesia.—A single induction dose is sufficient to cast the animal and to produce light anaesthesia of some ten minutes' duration. The plane of this anaesthesia tends to be deeper in the horse than in the ruminant, and is adequate for such operations as castration, minor tooth extractions and the suturing of accidental wounds in the former. In cattle, however, although the animal is deeply narcotised, there is, in a proportion of individuals, a degree of skin sensitivity, so that the use of a single injection tends to be limited to such operations as simple teat surgery, removal of small warts, foot trimming and dressing, and the like. The horns, however, are anaesthetised, and dehorning with a wire saw as described by Tazewell & Griffiths[5] may be carried out very readily with a single injection.

Maintenance of Anaesthesia.—We have found that by making further injections of " Anavenol "-K, full surgical anaesthesia can be produced and maintained for at least an hour. In our experience this period is sufficient for the great majority of surgical interferences in the bovine, but there is no reason why further injections should not be given if a longer operating time is required.

The optimum maintenance dose is found to be half of the volume required for induction, and must again be administered at the correct rate of 1 c.c. per second. Larger doses, while quite safe in volumes up to that of the induction dose, present no advantages, since they neither deepen nor prolong the anaesthesia to any appreciable extent beyond the dose stated.

The first maintenance dose is best given about five minutes after induction, and will give some 20 to 30 minutes total anaesthesia, sufficient for teat surgery, removal of tumours, extirpation of the eyeball, etc.

Under a second maintenance dose, anaesthesia is sufficient for such procedures as caesarean section, and we have carried out four of these operations with uniformly good results.

The second and subsequent maintenance doses are given as they are required, and their timing is found to vary to some degree with the nature of the operation, and the sensitivity of the tissues involved. In abdominal operations, for example, the induction and one maintenance dose will give up to 40 minutes operating time within the abdomen, but in amputation of a digit a second maintenance dose may be required after 10 or 15 minutes.

For example, in a caesarean operation, the site having been previously shaved and cleaned, anaesthesia is induced, the site finally sterilised, and the cloths clipped in position. The first maintenance dose is then given, and this produces anaesthesia of sufficient depth and duration for the opening of the abdomen and uterus, removal of the foetus, and closure of the uterus. The second maintenance dose is then given, and the muscle layers and skin sutured. In our hands the whole operation takes about 70 minutes, and the cow sits up some 10 to 15 minutes later.

An interesting and important feature of " Anavenol "-K is that it is non-toxic to the foetus, and following hysterotomy the full-term calf, although anaesthetised when removed from the uterus, recovers concurrently with its dam. A number of anaesthesias has been carried out on pregnant cows and mares without any ill effect whatsoever, and the drug may be recommended particularly for this class of animal since it also has the advantage of eliminating forced restraint and struggling of any kind.

The amputation of a digit, on the other hand, differs from abdominal interferences in that it is convenient to do most of the preparation of the site after induction, and thus the operation may not be started until after the first maintenance dose has been given. The skin and connective tissue are then cut down to the bone and if there is marked reaction to the division of the plantar digital nerves, a smaller maintenance injection may then be given before sawing the bone. In an operation carried out by this technique, the cow assumed a sitting position 35 minutes from the commencement of induction, and was standing after 50 minutes.

The extirpation of an eyeball may be carried out with an induction and one maintenance dose, but in one case in which there were extensive adhesions within the orbit, a third injection was found necessary before suturing the eyelids.

Toxicity.—No toxic symptoms, either immediate or delayed, have arisen in any of our cases, and it can be assumed that provided it is administered in the proper manner, "Anavenol"-K is virtually non-toxic. It has been shown experimentally that respiratory and cardiac embarrassment can be produced if the recommended injection rate is doubled, and cessation of these functions can occur if it is still more grossly exceeded. Also the administration of maintenance doses very much in excess of those recommended may result in cardiac arrest, but here again, the safety margin is wide, and death does not occur until these doses are more than doubled.

Discussion

In judging the value of any anaesthetic, the first question is probably the extent to which it prevents the subject from feeling pain, and "Anavenol"-K can be said to be highly efficient on these grounds. Under it we have conducted a number of operations involving sensitive structures and are convinced that sensation of pain is entirely absent. The animal is found to lie completely relaxed throughout the operation, and moreover it shows no fear or apprehension on subsequent occasions. In lactating cows there is little or no reduction in milk yield following anaesthesia.

As has been mentioned earlier, some individual bovines may show a degree of skin sensitivity in the lighter planes of anaesthesia, and this is probably due to the ascending action of the "Anavenol". When castrating bulls, for example, for which a single induction dose alone is sufficient, there may be a slight response on cutting the skin, which derives its nerve supply from the higher centres. The spermatic cord, however, which is ennervated from the spinal cord, is completely insensitive. In any case the administration of the first maintenance dose produces a plane of anaesthesia which removes even the slight degree of skin sensitivity remaining after the induction dose.

The relative toxicity of an anaesthetic is obviously of very great importance and here again we have found that "Anavenol"-K compares well with other agents in common use. Provided that it is used in the recommended manner, it has a wide margin of safety, and in pregnant animals the foetus is unharmed.

The question of the economics of anaesthesia has been fully discussed by Longley[6] and does not need repetition here, but it may be said that "Anavenol"-K is much less costly than the barbiturates, even when these are given by the rapid injection technique, and, when labour costs and risks are considered, is very little more expensive than chloral hydrate or chloroform.

A further consideration in assessing an anaesthetic is the ease and convenience with which both the subject and the drug may be handled. In this respect, "Anavenol"-K is outstanding, in that administration is simple, and at no time does the animal show the least excitement either on induction or recovery. No cumbersome apparatus is needed, either for administering the anaesthetic or restraining the animal, and recovery is so rapid that, where the surgical operation allows, horses may be put to work within an hour or so, and cattle may be returned to grass immediately.

In agricultural practice a number of relatively simple procedures such as hoof trimming in bulls, the suturing of accidental wounds, and even the clipping of restive horses are rendered tedious and often dangerous because of the difficulties of obtaining adequate restraint, particularly on small farms where little or no assistance is available. Again, in a number of minor but painful interferences such as simple teat operations, the removal of small tumours, and the like, the more widely used forms of anaesthesia, both local and general, are extremely cumbersome in relation to the operation itself.

We ourselves, for example, have used a single dose of "Anavenol"-K for rasping the teeth of a fractious horse and it was found that the operation was carried out in a fraction of the time and considerably more thoroughly than would have been possible by more orthodox methods of restraint.

It is submitted that in view of its safety and ease of administration, the drug will be found to be extremely valuable as a means of restraint alone in very many cases where anaesthesia would not normally be considered necessary.

Summary

1. The use of a mixture of β-naphthoxyethanol with thialbarbitone acid ("Anavenol"-K) as an anaesthetic in farm animals is described on the experience of 74 anaesthesias on 37 bovines, and 30 anaesthesias on ten horses.

2. The technique of administration is described, and it is stated that at an injection rate of 0·1 c.c. per second per cwt. the anaesthetic is safe and effective.

3. The quietness and absence of inco-ordination of the subject on induction and recovery are emphasised.

4. The position of the drug is discussed in relation to the usual criteria and it is suggested that in addition to its value as a general anaesthetic, "Anavenol"-K has a rational use as a safe and simple means of restraint.

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"Anavenol" and "Kemithal" are registered trade marks of Imperial Chemical (Pharmaceuticals), Ltd.

THE PREVENTION OF CATTLE PLAGUE

"Realising how deeply rinderpest affects the world food situation," writes a contributor to the issue of *Sport & Country* of August 9th, "the Food and Agriculture Organisation of the United Nations (F.A.O.) has launched an international campaign to eradicate this extremely contagious disease. Teams of F.A.O. experts are making available to countries affected by rinderpest the latest techniques of vaccine production, and already ruin and famine from this cause have been averted in many areas of Asia.

"The history of immunisation against rinderpest is a long one. A British scientist, J. T. Edwards, D.Sc., M.R.C.V.S., was the first to make use of 'passage' of the virus through goats, and his goat-attenuated virus vaccine enabled successful immunisation to be carried out on the largest scale. Later, the virus was passed through rabbits as well as goats. Then, during the last war, it was feared that the Nazis might use rinderpest virus as a biological weapon and spread it in Canada and the United States. Existing methods of vaccine production would have been far too slow and costly to protect all the herds of North America. And so, as part of a joint North-American biological defence plan, a secret research station was established. Here, after almost endless experiments, it was found possible to produce the vaccine—in bulk and cheaply—by growing the virus in hen's eggs. It is this method which F.A.O. is using to-day."

[An interesting reference to the topic raised in the above quotation is contained (p. 575) in the address given by Mr. W. Henderson, Nigeria, on "Achievements of the Colonial Veterinary Services in West Africa during the War" at the N.V.M.A. Annual Congress held in London on September 27th, 1945; see *Vet. Rec.*, 1945, December 8th. Vol. 57. No. 49. Pp. 574 to 578.—*Editor.*]

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UNIVERSITY OF LONDON
EXAMINATIONS IN VETERINARY SCIENCE

Following is the Pass List for the July, 1950, Second Examination:—Laing, William I'Anson Peter; Payne, Jack Marsh; Shipley, William; Tucker, Jean Winifred; Wilkinson, John Sydney; Wiltshire, Leslie Vasey, and Wood, Keith Halsted Benjamin, all of the Royal Veterinary College.

CLINICAL COMMUNICATION

TREATMENT OF BOVINE ACETONAEMIA BY THE SUBCUTANEOUS INJECTION OF MAGNESIUM SULPHATE

Results of Four Cases Investigated by the Department of Medicine, Royal Veterinary College

HAROLD BURROW AND E. FORDHAM LEWIS

For many years Mr. T. le Q. Blampied, F.R.C.V.S., of Jersey, has used magnesium sulphate injections as the specific therapeutic agent in cases of acetonaemia in Jersey cattle. As it was felt that a subacute hypomagnesaemia complicated by ketosis might be responsible for symptoms resembling those of acetonaemia, approach was made to Mr. Blampied to send blood samples before, during and after treatment of typical cases. Estimations of serum calcium, magnesium, acetone and whole blood inorganic phosphate were carried out. Four representative cases are described below. The histories, descriptions of symptoms and reports on progress were kindly supplied by Mr. Blampied.

CASE NO. 1. (Commenced April 27th.)

Cow (Jersey); age nine years; calved March 6th, 1950.

History.—Up to April 27th this cow was yielding 3 gallons of milk daily. On April 28th the yield had dropped to 1½ gallons and advice was sought.

Examination.—This showed temperature and gait to be normal. The coat was staring and the breath and milk gave off an odour of acetone. Besides pasture grass, the cow was being fed on hay, dairy nuts, bran and mangolds. She was still nibbling at her bran, nuts and grass, but refused hay and mangolds.

A similar attack on March 29th responded completely to a subcutaneous injection of magnesium sulphate.

Treatment.—Magnesium sulphate was administered subcutaneously (3 oz. in 16 oz. water at blood heat divided into two injections given in front of and behind the shoulder).

On May 2nd the cow was reported to have shown immediate improvement as evinced by better appetite and milk yield. The smell of acetone was considerably less. A further blood sample was taken before administering a second dose of magnesium sulphate.

On May 10th the report stated that improvement was maintained. Acetone was not perceptible, appetite was normal and no further treatment was given.

BLOOD ANALYSIS

Sample	April 28th	May 2nd	May 10th	
Ca.	9·8	10·2	9·2	mg. % of serum
Mg.	3·07	2·3	2·5	" " "
Inorg. P.	1·4	3·7	3·8	" whole blood
Acetone	30–40	15–20	Less than 10	" serum

CASE NO. 2. (Commenced April 27th.)

Cow (Jersey); age five years; calved April 5th, 1950.

History.—The cow developed "milk fever" at calving and was treated with calcium borogluconate on three successive days.

Examination.—This showed normal temperature and steady gait. Appetite was in abeyance. A slight smell of acetone was noted in breath and milk. Milk yield had dropped over the previous three days from 3 to 1½ gallons. During this period the owner had administered treacle. Diet was hay, bran, dairy nuts, oats, mangolds and grass at pasture. Magnesium sulphate was given by subcutaneous injection.

The cow showed definite initial improvement, but relapsed by May 2nd and appeared as badly affected as on the first examination. The subcutaneous injection of magnesium sulphate was repeated.

On May 10th the report stated that the animal's appetite was variable, her gait was unsteady and the smell of acetone persisted. On this occasion calcium borogluconate was injected intravenously.

May 15th—a visit to the case revealed marked improvement. The cow was obviously recovering rapidly, her gait was steady, milk yield increasing and appetite improving. No further treatment was applied.

BLOOD ANALYSIS

Sample	April 27th	May 1st	May 10th	May 14th
Ca.	8·4	9·8	8·6	11·3
Mg.	2·06	2·8	2·6	2·4
Inorg. P.	7·0	4·3	3·7	1·9
Acetone	80–90	60–70	50–60	20–30

CASE NO. 3. (Commenced May 8th.)

Cow (Jersey); age two and a half years; calved March 30th, 1950.

History.—The cow showed a sudden loss of appetite and reduction of milk yield. Her normal food consisted of hay, mangolds, grass (and occasionally crushed oats).

Examination showed temperature and gait to be normal. A smell of acetone was noted in breath and milk. She was treated by the subcutaneous injection of magnesium sulphate.

On May 12th a further sample was sent with the report that the cow was making an uneventful recovery without further treatment.

BLOOD ANALYSIS

Samples	May 8th	May 12th
Ca.	10·4	9·4
Mg.	2·0	1·4
Inorg. P.	3·7	3·3
Acetone	30–40	Less than 10

CASE NO. 4. (Commenced May 13th.)

Cow (Jersey); age two years four months; calved April 17th, 1950.

History.—Milk yield declined gradually and eventually the cow showed loss of appetite, a smell of acetone being noted in breath and milk. Food consisted of hay, grass and concentrates.

At the time of examination the cow refused concentrates but was still eating a little hay and grass. Her temperature and gait were normal. Treatment was again in the form of magnesium sulphate by subcutaneous injection.

On May 17th a further sample was submitted and the cow, having shown rapid recovery, required no further treatment.

BLOOD ANALYSIS

Samples	May 13th	May 17th
Ca.	11·0	11·8
Mg.	2·8	2·5
Inorg. P.	2·8	2·2
Acetone	60–70 mg.	10–20 mg.

COMMENTS

Case No. 1 appears to have been a straightforward acetonaemia which responded to treatment without much trouble.

Case No. 2 was symptomatic of acetonaemia and analysis proved the acetone level to be high. At the same time there was a narrowing of the Ca:P ratio. After the injection of calcium on May 10th the ratio widened and the elimination of acetone was accelerated. By May 14th, although the symptoms had disappeared, the acetone level was still a little above normal, though showing a progressive downward trend.

Cases Nos. 3 and 4 are included to illustrate the fact that the younger the cow the quicker the response to treatment.

The mechanism of the action of magnesium sulphate is imperfectly understood. The magnesium ion is necessary as a catalyst in carbohydrate reactions in the liver and it is possible that the injection of magnesium sulphate provides a massed supply of diffusible magnesium. The blood serum magnesium levels as demonstrated by the analyses are normal, but presumably the magnesium is not present in a form which is readily ionisable and diffusible. As in calcium metabolism, the diffusible mineral ratio would be of an interest equal to if not greater than the determination of the total content of the serum.

Udall refers to the use of magnesium sulphate in "conditions of hypomagnesaemia complicated by ketosis." Mr. J. R. Barker, M.R.C.V.S., D.V.H., has used magnesium sulphate in acetonaemias for a considerable period and he, in fact, suggested the treatment to Mr. Blampied in 1938.

Cases similar to those described have been followed up by members of the staff of this department. The animals were mainly Shorthorns, but the clinical and blood chemical pictures already described were found to apply. Basing one's opinion on clinical observation alone, the cases which receive an intravenous injection of glucose followed by magnesium sulphate subcutaneously respond a little more quickly than those which are given magnesium alone. This appertains particularly to older animals.

It is hoped that further extended trial of this comparatively simple therapeutic measure will prove its superiority over other more complicated and costly methods.

FEATURING FASCIOLA

Close upon the recent announcement that the British film "Sound" has been awarded the first prize in the scientific section of the Venice Film Festival comes the news that in the medical section the first prize has gone to the Central Office for Information for its film "Liver Fluke in Great Britain," made by the Basic Film Unit under the direction of Mr. John Shearman, who also wrote the script. The film shows by means of cine-micrography the various stages in the growth of the liver fluke, a parasitic worm found among cattle; the film also discusses the measures which can be adopted to prevent the disease from spreading.—*The Times.*

* * * * *

WEEKLY WISDOM

The great and recent growth of a sense of social obligation, common to almost all scientists, anticipates a recognition that science is not enough.—Dr. C. A. COULSON, Professor of Theoretical Physics in the University of London.

REVIEW

[Pipe Dreams about Leather and Saddles. By LEONARD K. MASON. Printed and published by Walsall Lithographic Co., Ltd., Walsall, England. Distributed by Simpkin Marshall, Ltd., London. (1950.) Pp. 84, with illustrations. Price 8s. 6d.]

Printed in type which is pleasurably easy to read, this comparatively small book, nevertheless, gives quite a wealth of information about leathercraft which is irregularly but entertainingly jewelled with comments on the source of adjuncts to the craft such as felt, hemp and flax; on historical matters such as the Guilds and the battle of Chalons in A.D.451; and there are many sound but unobtrusive hints on horsemanship scattered about. As the author says, "Dreams . . . wander where they will," and the wanderings—often quite unexpected—are impressive by their unexpectedness, and subtle sense of humour.

He makes one controversial statement, *i.e.*, the popular belief that there is a detectable difference between the offspring of an ass and a mare and that of a stallion and she-ass.

With its comprehensive index this publication may become a very serviceable reference book.

REPORT

[Australia: Commonwealth Scientific and Industrial Research Organisation. First Annual Report, for the year ended June 30th, 1949.]

The Commonwealth Scientific and Industrial Research Organisation was established in May last year. Under the terms of the Science and Industry Research Act, 1949, the Organisation took the place of the existing Council for Scientific and Industrial Research, whose work it will carry on. There has been a major change in administrative responsibility, in that the governing body of the Organisation is an executive of five persons rather than a large council. The executive, however, will be assisted by an advisory council constituted precisely as was the former C.S.I.R.

Research into problems of animal health has formed an important part of the Organisation's activities, and the report covers a wide range of subjects under investigation at the Division of Animal Health and Production's various laboratories and field stations throughout Australia.

It is stated that further progress was made in the study of the detection of tuberculous animals not reacting to routine intradermal tuberculin tests. The modified subcutaneous test ("short thermal test") proved of value in the field as a supplementary test for their detection. It appeared to have a useful application in constantly retested herds in deciding the status of cattle giving doubtful reactions to the routine tests. Of 133 tuberculous cattle which were submitted to this test, 122 (92 per cent.) reacted. Of 62 reactors to the routine intradermal test in which no visible lesions were found at autopsy, only ten had reacted to the short thermal test. "Judgment based on the latter would have saved from slaughter 84 per cent. of the animals in this group."

Among the pasture investigations carried out was one into the ecology of *Heliotropium europaeum*, a weed shown to be directly responsible, through liver damage, for a large number of deaths previously attributed to toxaemic jaundice. Evidence so far available suggests, states the report, that sheep grazing on this plant are more likely to develop an abnormally high liver copper content.

G. P. W.

(*Continued at foot of col.* 1, *page* 512.)

VICTORIA VETERINARY BENEVOLENT FUND

MEETING OF COUNCIL

A meeting of the Council of the Victoria Veterinary Benevolent Fund was held at 10, Red Lion Square, London, W.C.1, on Wednesday, June 28th, 1950, when the following members were present:—Lt.-Col. P. J. Simpson (President) in the chair, Mr. Horace Bell, Professor J. B. Buxton, Mr. Arnold Spicer and Major W. H. Wortley. Mr. C. W. Francis (Accountant) was in attendance.

Minutes.—The minutes of the previous meeting held on April 13th, 1950, having been published, were taken as read and signed as correct.

Apologies for Absence.—Letters of apology for absence were received from Prof. T. G. Browne, Mr. H. W. Dawes, Mrs. D. I. Glover, Prof. R. E. Glover, Mr. G. N. Gould, Mrs. B. W. Hill-Owens, Mr. G. P. Male, Capt. T. M. Mitchell, Prof. W. M. Mitchell, Capt. J. W. Procter, Mr. H. W. Steele-Bodger, Capts. W. Watt, A. Whicher, Prof. G. H. Wooldridge, Mrs. E. B. Wooldridge and Dr. W. R. Wooldridge.

Correspondence.—(*a*) A letter from Major W. H. Wortley, expressing his thanks and those of his daughters for the kind message of sympathy sent by the Council in connection with the passing of his wife, was read.

(*b*) A communication from the British Rheumatic Association, together with particulars of a Home for the Rheumatic, proposed to be established at St. Anne's, Buxton, were considered, but it was decided to take no action in the matter.

(*c*) A letter was received from Mr. P. E. Mullaney, Hon. Secretary of the Veterinary Medical Association of Ireland, acknowledging particulars of the cases receiving grants in his country, and stating that a Special Committee set up to investigate these cases had commenced its enquiries and would report to the Council as soon as they were completed.

Bequests.—The Treasurer submitted particulars, as under, of two Bequests to the Fund:—

(*a*) *Major James Harrison's Estate.*—Died August 25th, 1949. Subject to the life interest of the deceased's Widow and the payment of certain legacies on her death, the residue of the Estate is bequeathed to the Fund. Estimated that this will approximate £3,000 less Estate Duty on certain annuities.

(*b*) *D. B. Rodger Trust.*—Died October 8th, 1931. In 1932 the Fund received a legacy of one hundred guineas less Legacy Duty, and was advised that the Estate was to be life-rented by the deceased's Sister, Mrs. Janet L. Gilmour. That on her demise the residue, after payment of five legacies of £100, was to pass to the Victoria Veterinary Benevolent Fund.

A letter dated June 23rd, 1950, was read stating that Mrs. Gilmour died on December 6th, 1949, and that the amount of the residue, after the deduction of the said Legacies and Death Duties is expected to be in the region of £1,100.

Investments.—The Treasurer reported credit balances in the Hunting Fund Account and the Donations Accounts of £326 11s. 1d. and £530 respectively, and asked for instructions as to their investment.

The Treasurer was requested to arrange for the investment of the Hunting Fund balance in the purchase of 3 per cent. British Transport Guaranteed Stock, 1978-88, and the amount in the Donations Account in the purchase of 3½ per cent. War Loan, 1952.

Accountant's Report

The Accountant submitted the following report which was approved.

Since the previous Quarterly Meeting of Council, the following Donations have been received:—

Collecting Boxes

	£	s.	d.
Dumfries and Galloway V.M.A.	7	0	0
East Midlands Division, N.V.M.A.	5	17	6
Herts and Beds Veterinary Society	4	5	0
Scottish Branch, N.V.M.A.	3	7	9
Scottish Metropolitan Branch, N.V.M.A.	2	14	5
Total Collecting Boxes	23	4	8
Association of State Veterinary Officers	10	10	0
Bexhill Horse Show (per Capt. A. Whicher)	10	10	0
Eastern Counties Veterinary Society	10	0	0
J. W. H. Holmes (Life Membership Fee)	10	10	0
Midland Counties V.M.A.	5	5	0
Scottish Metropolitan Branch, N.V.M.A.	10	0	0
Students Union Entertainments Committee (Royal Veterinary College)	9	17	4
In memory of Mrs. W. H. Wortley—			
Eastern Counties Veterinary Society ... 5 5 0			
Mr. and Mrs. G. Smith 2 2 0			
	7	7	0
Society of Veterinary Practitioners	125	0	0
Sutton & Cook (Northampton Canine Society, Honorarium)	4	4	0
A. Spicer, commission account, re Mr. Hogarth Scott	8	18	9
Basil O. E. Walpole	1	1	0
	£236	7	9

Life Member.—It was resolved:—

That Mr. J. W. H. Holmes, M.R.C.V.S., D.V.S.M., be elected a Life Member of the Fund.

Cases

(i) Application.—The Hon. Secretary, having read the details of an application submitted by a firm of solicitors acting for the widow of a veterinary surgeon, aged 64, it was agreed that the consideration of this case be deferred until the decisions arrived at by the two other bodies, who had been approached by the applicant, were made known to the Council.

(ii) *New Cases.*— No. 274. Widow, aged 77. One daughter, married, who contributes £1 per week. Total income, including Old Age Pension, £1 16s. 0d. Grant made by Executive Committee of £4 6s. 8d. per month.

The action of the Executive Committee was approved.

No. 275. Widow, aged 45, two sons 16 and 13, both at school. Receiving temporary grant of £1 weekly from Tanganyika Government.

The Executive Committee reported that in view of her financial circumstances they had made a special grant of £10 until the case could be considered by the Council. They also reported on an interview which they had had with this applicant.

Reports, etc., also received.—**Proceedings of the Twelfth Meeting of the British Society of Animal Production,** held at Cambridge, August 29th to September 1st, 1940. General topic: "The Livestock of East Anglia." Published by the Society (Secretary, Mr. J. P. Maule, King's Buildings, Edinburgh), price 6s.

Annual Report of the Civil Veterinary Department, Assam, for the year 1947–48.

Annual Report of the Department of Veterinary Services, Colony and Protectorate of Kenya, for the year 1948.

The action of the Executive Committee was approved, and it was resolved, further, that a grant of £13 per month be made to this applicant for the next six months, after which the case should be reviewed further.

STAFF APPOINTMENTS

The President referred to the minutes of Council held in April last and reported that the Executive Committee, having very carefully considered this matter, submitted the following recommendations for the consideration of Council:—

(*a*) That Mr. C. W. Francis, formerly Accountant, be appointed Secretary of the Fund; that he be authorised to sign and endorse all cheques and other documents of the Fund, and that the Fund's bankers, Messrs. Barclays Bank, Ltd., 5-6, Henrietta Street, London, W.C.2, be informed accordingly.

(*b*) That Mr. Ronald Shee be appointed Accountant in the place of Mr. C. W. Francis.

On the proposition of Major W. H. Wortley, seconded by Mr. H. Bell,

It was resolved:—

That the report be received and adopted.

Date of Next Meeting.—It was agreed that the date of the next meeting be left in the hands of the Executive Committee.

NOTES AND NEWS

Diary of Events

Sept. 3rd-8th.—Sixty-eighth Annual Meeting and Congress of the National Veterinary Medical Association, at Cardiff.

Sept. 7th.—Annual General Meeting of the V.V.B.F. Ladies' Guild at Cardiff (City Hall), 10.30 a.m.

Sept. 7th.—Annual General Meeting of the Association of Veterinary Teachers and Research Workers, at Cardiff (Technical College, Cathays Park), 11.45 a.m.

Sept. 15th.—Meeting of the Southern Counties Division, N.V.M.A., at Southampton (Polygon Hotel), 6 p.m.

Sept. 28th.—Summer Meeting of the East Midlands Division, N.V.M.A., at Thurgarton, Notts. (See Notice.)

* * * * *

N.V.M.A. Handbook, 1950

The above handbook, containing the lists of officers, committee and other members of the Association, the annual report, etc., together with the full programme of the annual meeting and congress at Cardiff, was despatched to members during the past week, accompanied by copies of the papers to be presented. Any member whose set of documents has not reached him by the time he receives this copy of *The Veterinary Record* is asked to inform the General Secretary.

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PERSONAL

Animal Health Trust Farm Livestock Research Stations

APPOINTMENT OF DR. F. C. MINETT AS DIRECTOR

The Animal Health Trust announces the appointment of Dr. Francis C. Minett, C.I.E., M.B.E., D.SC., M.R.C.V.S., as Director of the Animal Health Trust's group of Farm Livestock Research Stations at Houghton Grange, Huntingdonshire.

Houghton Grange, which comprises farming estates of over 800 acres, was purchased in October, 1948. Hitherto the work involved in altering the farming policy to suit the needs of research, in modifying the layout of the buildings and plant, and in installing the foundation herds of livestock, has been supervised by Professor Wm. C. Miller, M.R.C.V.S., F.R.S.E., in addition to his duties as Director of the Trust's Equine Research Station at Newmarket.

Now that the Houghton estate is carrying the foundation stock, as well as producing feeding-stuffs for the animals at all the Research Stations under A.H.T. auspices, the work involved in planning the further development of the Livestock Stations, including laboratories and research work, calls for full-time scientific direction. Dr. Minett's appointment will provide this.

DR. F. C. MINETT

Dr. Minett, who was educated at King Edward's School, Bath, qualified from the Royal Veterinary College, London, in 1911. Taking his B.Sc. in 1912, he was Ministry of Agriculture Research Scholar from 1912-14, when he served in the R.A.V.C. in England, France and Egypt, retiring as Captain and receiving the M.B.E. in 1916. Following a period as Research Officer with the Ministry at Weybridge, from 1927-39 he was Director of the Research Institute in Animal Pathology at the R.V.C., London, taking the D.Sc. (Veterinary Science) of London University in 1928. In 1932 Dr. Minett was appointed Professor of Pathology in the College, a post which he held until 1939, when he went to India as Director of the Imperial Veterinary Research Institute, Muktesar and Izatnagar. In 1947 Dr. Minett became Animal Husbandry Commissioner, Government of Pakistan, retiring in 1949.

In the year 1945 Dr. Minett was awarded the C.I.E. In 1946 and 1948 he was Foreign Corresponding Member of Royal Academy of Medicine of Belgium, and of the French Veterinary Academy.

Among the researches conducted by Dr. Minett, alone or in collaboration, has been work on bovine tuberculosis, contagious abortion, Johne's disease, foot-and-mouth disease, and mastitis in cattle.

During his career Dr. Minett has published upwards of 50 original research articles, mostly on the pathology and bacteriology of disease conditions of farm livestock.

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Miss Lobban's Cambridge Appointment.—In its issue of July 6th the *Cambridge University Reporter* records the recent appointment of Miss M. C. Lobban, B.A., M.R.C.V.S., of the Department of Physiology, Downing Street, Cambridge, as Fellow of Newnham College and Director of Studies.

. . . . . .

CAPTAIN VINCENT BOYLE, C.M.G., M.R.C.V.S.

As many of our readers will be aware, Captain Vincent Boyle, Superintending Inspector of the Animal Health Division of the Ministry of Agriculture and Fisheries, has been stationed in Buenos Aires for some years as the representative of the British Ministry in connection with the implementation of arrangements agreed with South American countries for safeguarding Great Britain from the introduction of foot-and-mouth disease from that area.

In connection with one of Captain Boyle's recent tours of duty, Dr. Theodor Pilz—a recent and most welcome visitor to this country—writes from Montevideo:—"You may be interested in the enclosed photograph of the Minister of Agriculture of Uruguay, Mr. Carlos Fischer, in conversation with Captain Vincent Boyle of the British Veterinary Mission in the River Plate, taken at the Rural Society Show in Montevideo. Captain Vincent Boyle was specially invited to attend the annual livestock show in Montevideo by the Uruguayan Government and the Rural Society."

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

SWINE FEVER:

Hants.—Broadley Farm, Wootton, Newmilton, Hants (Aug. 14th).

Lancs.—Moss Bourne Piggeries, Garstang Road, Poulton-le-Fylde; Wadacre Farm, Waddicar Lane, Melling, Maghull, Liverpool, Lancs (Aug. 16th).

Notts.—42, Forest Lane, Manton, Worksop (Aug. 16th); Allotment Gardens, Thoresby Road, Mansfield, Woodhouse; Broadoaks, Oaktree Lane, Mansfield (Aug. 18th).

Surrey.—The Retreat Farm, Chertsey Lane, Staines; carcase at M.o.F. slaughterhouse, Chertsey, Surrey (Aug. 17th).

Yorks (*E. R.*).—"Zria," Lime Tree Lane, Bilton, Yorks (Aug. 19th).

Yorks (*N. R.*).—Ashfield Farm, Stockton Lane, York (Aug. 17th); Brecks Farm, New Lane, Huntington (Aug. 19th).

Yorks (*W.R.*).—Blackhill Farm, Eccup, Leeds; High Lindrick Farm, Ripon (Aug. 18th).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the N.V.M.A.

SULPHA DRUG TREATMENT FOR CAECAL COCCIDIOSIS

Sir,—I have been interested in the recent correspondence in connection with the treatment of avian coccidiosis with sulphamezathine and as a considerable amount of work, as yet unpublished, has been done here during the past few years the following observations may be apposite.

Generally speaking, chicks show a greater reluctance to drink water medicated with sulphamezathine (0·2 per cent.) than with the other sulphonamides: sulphaquinoxaline, sulphamerazine and avisol are taken more readily.

It is not my intention now to discuss the relative merits of these drugs beyond stating that in the chicken there is little to choose between drinking water medicated with sulphamezathine, 0·2 per cent. or sulphaquinoxaline, 0·06 per cent. The latter is much to be preferred in the turkey, which may completely refuse drinking water treated with sulphamezathine. Dr. Blount states that chicks take avisol more freely than sulphamezathine. We can confirm this, but it must be pointed out that the relative efficiency of the various sulphonamides does not necessarily bear any relationship with the amounts consumed. We have shown repeatedly that the comparatively small amounts of sulphamezathine consumed are generally completely effective in preventing deaths from acute caecal coccidiosis (*E. tenella*). The important factor in the success of treatment, and it is equally true in the case of sulphaquinoxaline, is the interval which elapses between the time of infection and the beginning of treatment. Up to 48 hours after infection, complete protection is obtained by the use of both drugs; in most cases this is true up to 72 hours. After that time results are uncertain, and if treatment is delayed for more than 84 hours the mortality in treated chicks may not be significantly different from that of controls receiving drinking water only.

This seems to offer the most likely explanation of the so-called "failure" of routine treatment in some outbreaks and stresses the value of a speedy diagnosis and prompt initiation of treatment. To that end it is our custom here, whenever the per-acute disease is diagnosed, to issue a report by return of post.

I wish to make it clear that the above observations refer to acute caecal coccidiosis experimentally produced by the administration of a single large dose of infective material with the opportunity of reinfestation reduced to a minimum.

Yours faithfully,
J. E. WILSON.

Ministry of Agriculture and Fisheries,
Veterinary Laboratory,
Eskgrove, Lasswade, Midlothian.

August 5th, 1950.

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BRACKEN POISONING: ITS CAUSE AND CONTROL

Sir,—I have just read Dr. J. T. Edwards' annotation on bracken poisoning in the August 5th issue of *The Veterinary Record*. I think it is an excellent annotation on the subject and gives a very useful summarised version of the subject as it stands to-day.

However, I do think it is rather a pity that throughout the whole article, the workers at Aberystwyth are not on any single occasion referred to by name, although workers at other centres have been named. I know that Dr. Edwards gives the relevant references to the Aberystwyth workers and anyone closely interested can look them up to find out who were concerned.

Yours faithfully,
D. L. HUGHES.

Hill Farm House,
Thurgarton,
Notts.

August 15th, 1950.

. . . . .

Dr. EDWARDS writes:—"Mr. D. L. Hughes is, of course, quite right in drawing attention to the omission of reference to the Aberystwyth workers by name from the annotation in question. Far from having any desire, however, to depreciate them personally, the intention was to draw early the attention of veterinary readers to what seemed to be valuable work done by those workers, of much importance in its probable significance to a large section of the veterinary profession. As you will recall, sir, the script was originally submitted to you as a note for publication in your Notes and News columns in the ordinary way and so it had been composed with an eye primarily directed towards easy readability rather than meticulous particularism. It is comforting to notice that your decision to publish it as an annotation has met with such favourable comment from Mr. Hughes, to allay whose perfectly understandable disquiet a list of the papers already published by the Aberystwyth workers is subjoined:—

EVANS, W. C., & EVANS, E. T. R. (1949.) *Biochem. J.* **44.** ix.
—— & ——. (1949.) *Brit. vet. J.* **105.** 175.
ROBERTS, E., EVANS, E. T. R., & EVANS, W. C. (1949.) *Vet. Rec.* **61.** 549.
EVANS, W. C., JONES, N. R., & EVANS, R. A. (1950.) *Biochem. J.* **46.** xxxviii."

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ATTESTATION: IS IT A GOOD POLICY?

Sir,—In his letter of August 7th, 1950, Mr. A. J. Wilson writes ". . . the very old phrase—a little knowledge is a dangerous thing."

Pope in his Essay on Criticism wrote:—

"A little learning is a dangerous thing;
Drink deep, or taste not the Pierian spring:
There shallow draughts intoxicate the brain,
And drinking largely sobers us again."

Yours faithfully,
R. MACKAY DAVIDSON.

8, Regent Street,
Hamilton, Lanarkshire.

August 18th, 1950.

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HOMOEOPATHY IN THE VETERINARY FIELD

Sir,—My letter suggesting a calling of a meeting of members of the profession interested in homoeopathy has met with a gratifying response and a meeting of such is assured, probably early in September. The Council of the British Homoeopathic Association is very kindly issuing invitations to those correspondents who have written to me.

In reply to Professor Wooldridge's letter, let me first hasten to assure him I had no intention of labelling him with any unorthodox creed; it was solely my admiration for my old teacher when he showed such broad-mindedness in advising me during the consultation that kept the incident in my memory and led me to quote it.

The case was one where a West Highland terrier was severely affected in all four feet with interdigital cysts. Old chronic sinuses extended nearly up to the wrist joints, and there was a great deal of scar tissue following on the inflammation of many years' standing. Within a week of starting the suggested remedy (Graphites 3X) the condition was phenomenally improved, and the animal, which had been a real sufferer and had undergone many operations for seven or eight years, lived on to a ripe old age without any further need for treatment for this complaint. It is not surprising that Professor Wooldridge does not recollect the incident, for it was in the late '20s that the consultation took place.

Yours faithfully,
R. C. G. HANCOCK.

Springhurst,
Ecchinswell,
Newbury, Berks.

August 21st, 1950.